VOLUME 16 NO. 1
Jan. - Feb., 1953

Journal of

MILK and FOOD TECHNOLOGY

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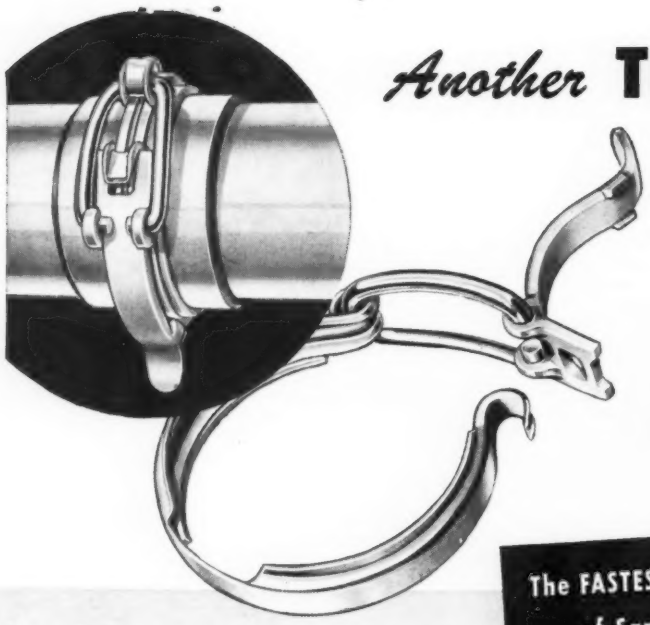
Official Publication

International Association of Milk and Food Sanitarians, Inc.



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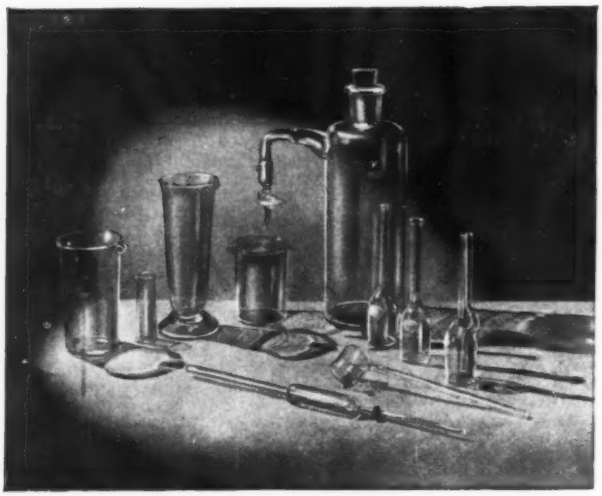

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INCLUDING MILK AND FOOD SANITATION

Official Publication

International Association of Milk and Food Sanitarians, Inc.

VOL 16 — JANUARY-FEBRUARY — NO. 1

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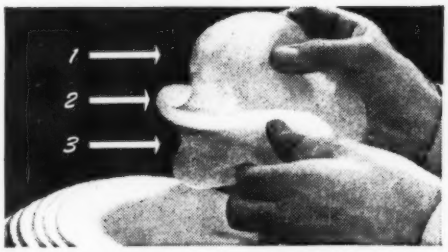

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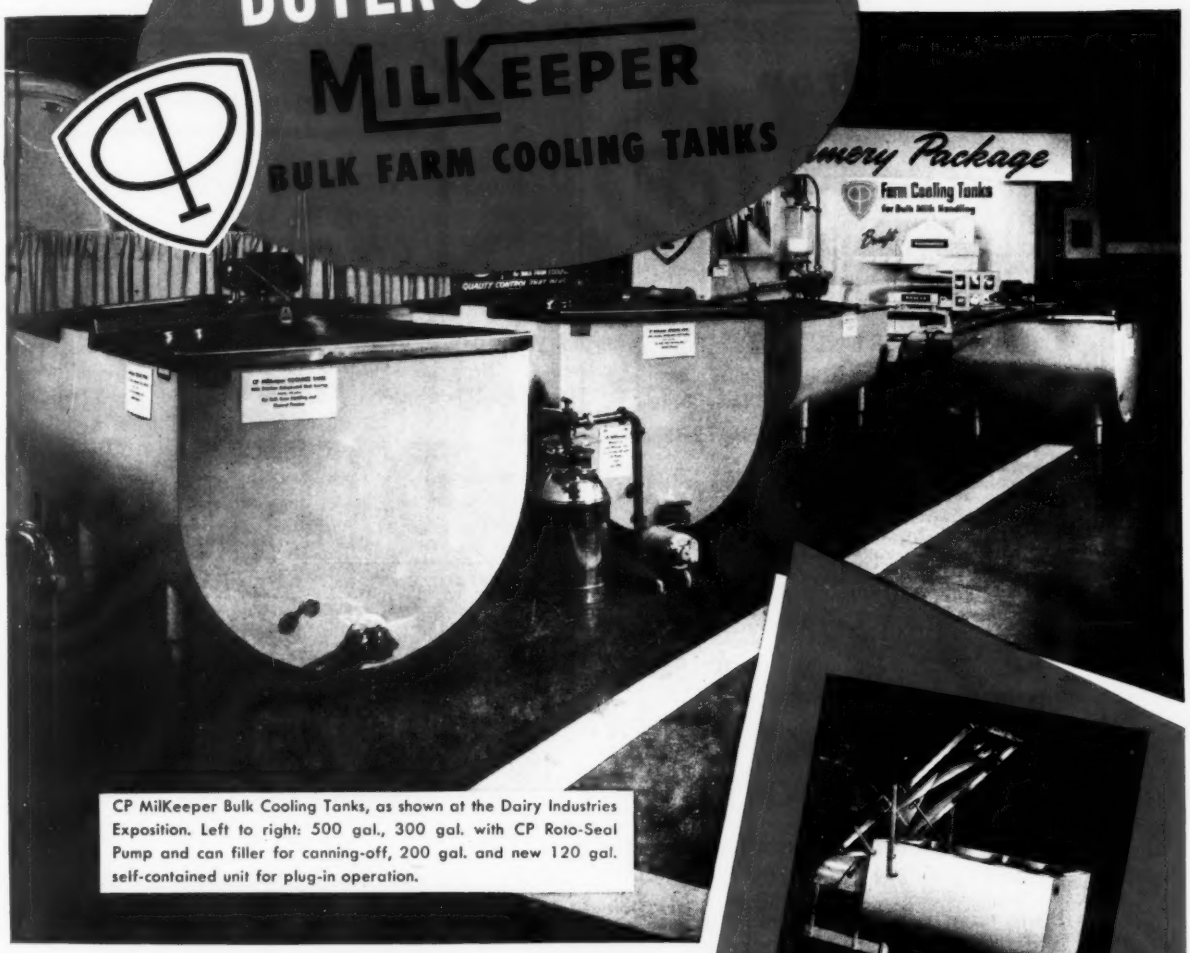
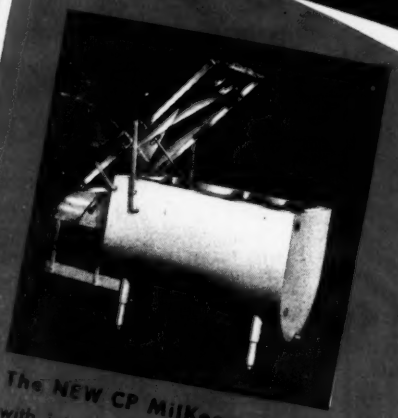


CP MilKeeper Bulk Cooling Tanks, as shown at the Dairy Industries Exposition. Left to right: 500 gal., 300 gal. with CP Roto-Seal Pump and can filler for canning-off, 200 gal. and new 120 gal. self-contained unit for plug-in operation.



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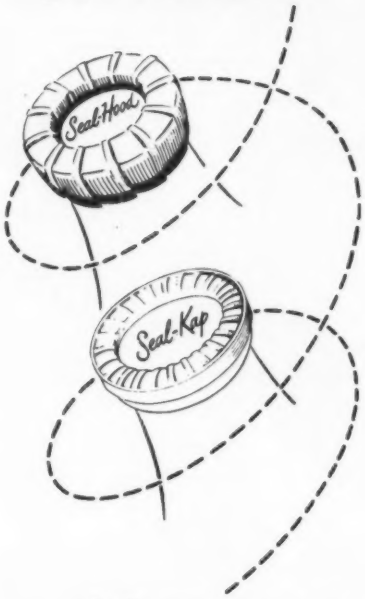

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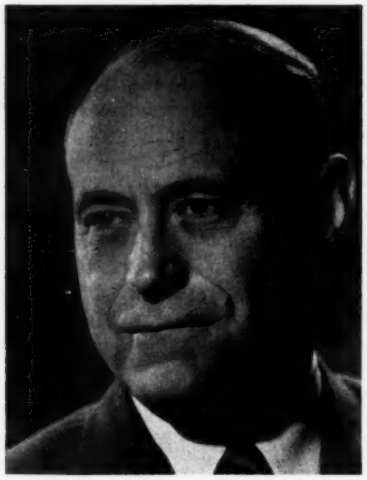
Editorial Notes

THE PRESIDENT'S MESSAGE



I would be unfair to myself if I did not admit that I am proud to serve the members of the International Association of Milk and Food Sanitarians as President for the coming year. I consider it a high privilege and an experience worth many times the effort necessary to carry out the duties.

It has been my good fortune to be a member of this Association for more than twenty years. My long association with the men, who have through the years guided the destinies of this Association, has developed in me a high regard and profound respect for their character and judgement. Knowing them intimately has given me a rich experience which will be very helpful in tempering the decisions that must be made during the year. It would be a wonderful thing if every person in the field of milk and food sanitation could experience the opportunity which has been mine during the past two years and which lies ahead for the coming year.

The Executive Board is made up of individuals whose loyalty to the Association and its objectives is unquestioned. All branches of the profession and each section of the country are represented on the Board. Each member has had many years experience in milk and food sanitation. Each man is independent in his thinking. The affairs of the Association are in strong hands.

The establishment of the office of Executive Secretary of the Association in 1951 was a most successful move. In 1952 it was proven that the establishment of a full time Executive Secretary, who also serves as Managing Editor of the *Journal*, was good business. The consolidation of the business of the Association in one location under the direction of "Red" Thomasson was timely. The financial structure of the Association is sound. "Red" has established himself as a competent and enthusiastic Secretary and Managing Editor. His confidence in himself and the objectives of the Association is inspiring and contagious. We look forward to a steady growth in membership and stature of the Association. Last year five new affiliates were added and several more are in the process of forming.

Your Executive Board has under consideration a number of objectives for the coming year. Among them are:

1. A thorough study of Professional Status with a determined effort to offer the membership an acceptable program and policy on Professional Status.
2. A possible revision of the Constitution and By-Laws to provide the formation of committees before the Annual Meeting rather than after, thereby giving each chairman a chance to meet with his committee during the Annual Meeting and plan for the year's work.
3. A possible revision of the Constitution and By-Laws to more clearly define the organization and function of the Council.
4. Expansion of the activities of the Educational Committee.
5. More widespread use of the *Journal* particularly in high school libraries.
6. The establishment of a monthly publication in place of the bi-monthly now published.
7. Participation in Association activities by al members and continued promotion of the activities and benefits to be derived from membership in the Association. Maximum accomplishment is possible only with an informed membership.
8. Continuation of the $1000 sanitarians award.

In September the Minnesoto affiliate was host to the most successful Annual Meeting yet held. A total of 496 persons were registered. We will long remember the fine fellowship, the wonderful entertainment, the outstanding technical papers and the many new friends it was our privilege to make. The Minnesota Association did a job hard to surpass.

At the moment the Michigan Affiliate is hard at work preparing for the 1953 Meeting at Michigan State College in East Lansing during the first week of September. This will be the first time in the history of the Association that we have met at a College or University. Michigan State has unusual facilities for such a meeting. The date was purposely set for this week so that we might have unlimited facilities, families might attend with their children before school starts, and college personnel from other Institutions may participate. Why not make your plans now to attend the 1953 Annual Meeting at Michigan State College? I look forward to seeing each one of you there.

I am sure that 1953 will be a year of steady, sound growth for our Association.

HAROLD J. BARNUM
President

THE MERIT SYSTEM FOR FOOD SANITARIANS*

". . . I have been a local health officer for the last sixteen or seventeen years. During this time I have functioned under the leadership of both political parties. Following municipal elections I have seen changes in the personnel of the Board of Health. I have seen men and women who have been faithful to their work, who have done their jobs in a commendable way, discharged without any consideration for their past performances. I have seen men and women, employed in health work for years, discharged without any pension to help them in old age. I have seen men and women discharged faced with the uncertainty of finding new jobs of an entirely different type to which they must adapt themselves.

"It has been painful to see faithful employees so treated. Laying aside my own personal feelings in the matter, it has been time-consuming and expensive to train these people, and I am sure the tax payer is interested in keeping at a minimum the amount of money needed to train professional personnel. The greatest objection, however, to such procedure is the danger it creates to the health of the community. New people, in order to be efficient, must spend time and study to acquaint themselves with their new job. During this period of training the health of the people is neglected, and this is a serious matter.

"I believe there is an answer to this problem. It seems very simple to me to state that all professional personnel such as milk and food sanitarians should be employed on the merit basis with some type of retirement plan which will provide a pension after years of faithful service.

Philosophical Considerations

"And now I want to spend some time in a philosophical way developing the subject assigned to me, namely, the professional status of milk and food sanitarians.

"Most men have always been insecure. Only a few of us will inherit enough of this world's goods to be secure, and even when one is so lucky as to be born in this condition of security he may either knowingly or unknowingly loose his marvelous patrimony. Security is the dream of every able-minded individual. "Many ways of established security have been developed. Early in the history of our Nation, it was easy to establish claim to a certain section of land. The owner found it necessary to clear such land of timber, thereby, creating an area upon which he could grow his livelihood. He had his fuel from the timber as well as the lumber to build his house. Wild game provided his meat. In a way this early settler had a greater amount of security than any other citizen of a later period in American history. This early inhabitant did not use money as a medium of exchange. Barter constituted his method of trade.

"Once money began to be of general use, this also became a method of offering security. One could lay away a part of his wages. This could either be invested later for enhancement or it could merely be kept as a security against want. The gold standard of the U.S. made the purchasing power of the dollar fairly stable.

"Another method of obtaining security was the purchase of insurance of different kinds. Health and accident, life insurance, etc. are different kinds of insurance that one could buy. This type of security constituted a gamble. In other words for a certain fee a person paid an insurance company to assume the risk of probable sickness. Many times the sickness did not occur; and this fact made it possible for the insurance company to exist.

"I do not care to tire you by listening to different methods that people have used in the past and even at present to obtain security. Let me say only that during the present century man has become progressively less secure, than in any other period of American history. The purchasing power of the dollar is now at an all time low. The terrific cost of government makes it impossible to save even de-valued dollars to take care of the future. More than one-third of every dollar which you make today is returned in the form of taxes to support various government structures. This means that the income from 10 days of work out of every 30 is taken away from your family budget. This constitutes the economic background in which you as sanitarians are working.

"What does a man wish to be secure against? Four different types of insecurity present themselves as avenues for consideration. They are the insecurity of old age, the insecurity of unemployment, the insecurity of sickness, and finally the insecurity of death, particularly that of the breadwinner.

"Old age entails inability to work. A man's physical and mental ability may not parallel each other but will reach a peak of productiveness and then gradually decline. A life time of work ends in proverty or dependence unless the worker is fortunate enough to save a sufficient sum to provide him until he dies.

"Most of our population must work for a living. Unemployment means no income. An individual whether he be single or the breadwinner for a family is still faced with the necessity of providing the essential things of life.

---

*Excerpts from address of Dr. F. R. Nicholas Carter, City Health Officer, South Bend, Indiana, at the Second Annual Meeting of the Indiana Association of Milk and Food Sanitarians, June 24 - 26, 1952.

"Again we have the hazard of ill health. An illness of short duration may entail only a minor amount of economic disturbances; however, long term illness is a terrible hazard to the family. Catastrophic illness is hard to endure, especially if it involves the breadwinner. Thank God, insurance plans are in existence which make it possible to budget medical and other types of sickness care.

"Death of the breadwinner, sometimes almost completely banishes the security of the housewife and the children. This constitues a sad plight for the family. . . .

"Unless you have provided privately some method of overcoming the four types of insecurity which I have mentioned, you are faced with gnawing uncertainty of the future. Your local government has made no provisions to protect you from any of these wants.

MERIT SYSTEM

"What do we mean by the merit system? Broadly we mean that any employee should receive employment on the basis of his ability to perform his duty.

"In my mind the most important requirement of a milk inspector should be the possession of a mind of such type that it will able to learn the facts surrounding the job for which he applies. Then he should be acquainted with bacteriology since daily he will be dealing with germ life. He should be politic, since his job is education, and he should only resort to police methods occasionally.

"He should be a bookkeeper, since he will be required to keep great numbers of records and charts. Furthermore, he must have a respect for law and always act within the limitations provided by his job. Finally, he should have a broad training in subjects which affect the health of the people for whom he will work.

"I could probably add many more qualifications to this list. Already I have established in your mind, I am sure, that a milk and food inspector is a peculiar individual. He is a specialist in his field. He should receive employment upon the basis of how many of the above qualifications he possesses.

"What is the usual procedure? Ordinarily the party in power sends anyone around to the health department who has delivered some type of political favor. He may not have a single one of the above essential requirements. He may be so dumb as to be unable to learn even the simplest requirements of the job he is called upon to perform. The health of the Community over which he is to be watch-dog is not given one single consideration in his employment. Such an employee is a health hazard on a salary. This seems almost criminal, yet both political parties carry out exactly this procedure. Surely the health of the community is of enough importance that it should be considered in the employment of every individual who works in the health department.

TENURE

"Once employed after a trial period of adjustment, a person found to be capable of performing his work as an inspector should be placed under permanent employment, and provision of such nature should be set up that he cannot be discharged unless very definite cause is shown. Even then he should have the right to appeal to a higher court for final decision. This system is in daily use in our federal government and in state government. A system of his type is used in 2nd-class cities to secure the jobs of the electricians, the firemen, and the police. The Teachers Tenure law provides that once a teacher has established her ability to perform her duties, she cannot be discharged without reason. Why, oh, why cannot we have the same system among our sanitarians?

SECURITY

"Again I want to return to the four types of security which we all crave. Are sanitarians or other health officers any different from any other human beings? Do the four types of insecurity mean so little to us that we should go on blindly doing our job until some day we are old and then realize that we do not have the securities? I am sure that everyone of us wants protection against these fears. The only way to obtain such protection is to face the problem during our years of earning. Surely some type of legislation can be secured whereby the employer and employee can retire a certain percentage of his salary to meet these insecurities. Industry has done this in a very commendable way. It seems to me that the very first function of this organization should be the sponsoring of legislation that will set up a method whereby a merit system of employment can exist in local governments. More than this, a system to cover periods of unemployment, periods of illness, and even insurance against death could be provided. Surely a pension should be a bulwark against old age.

"With the dollar becoming less and less valuable, I believe the government must take part in this program. . . . The percentage deductions from salaries, with the government matching with a certain amount, has proven acceptable in industry. Probably this would prove acceptable to the sanitarians. I am convinced that some type of merit system with pension retirement should be provided in local government.

THE INFLUENCE OF DDT WETTABLE POWDER ON THE METHYLENE BLUE REDUCTION TEST IN MILK

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DDT has been detected in the milk of cows fed forage crops exposed to the insecticide. DDT, in the form of a wettable powder, was added to raw milk to determine its effect on the methylene blue reduction test. The results indicate that the presence of appreciable quantities of DDT wettable powder materially interfere with the accuracy of the test. Care should be exercised in interpreting reduction tests of milk containing this insecticide.

The methylene blue reduction test has been widely accepted in the dairy industry as a qualitative method for checking the sanitary quality of raw milk. The rapidity of the reduction time of the dye in milk may be influenced by several factors, particularly the kind of organisms in the milk. Recently, the use of various insecticides on forage crops has introduced a relatively new factor. If DDT is present in the milk in varying quantities, what will be the effect of this insecticide on the accuracy of the methylene blue test? Different concentrations of a DDT wettable powder were added to raw milk samples produced under a variety of sanitary conditions. No forage crops containing DDT were available at the time of this investigation.

Review of Literature

Many inherent and environmental factors may influence the relationship of dye reduction and the numbers and/or kinds of organisms present in the milk. Davis and Lines[2] have noted that the concentration of dye plays an important role in the reduction time. The temperature of incubation of the dye-milk mixture as reported by Hastings *et al.*[4] showed a wide variation in the time of reduction of the methylene blue. The pre-test holding-temperature as noted by Frayer[3] was another factor and was confirmed by Wilson.[11] The work of Aikins and Fay,[1] Frayer[3] and Jackson[7] indicated that light may be an important factor in the reduction time, and they suggested that the tubes should be protected from light rays.

Schecter *et al.*[8,9] and Howell *et al.*[6] reported that DDT could be detected in milk in concentrations of 25 ppm and higher depending on the cow's intake of DDT present as residue on the forage crops the animal consumed.

These observations prompted us to investigate the possibility that DDT also might interfere with the accuracy of the methylene blue reduction test in milk.

Materials

Since milk was not available from cows fed DDT forage crops, *in vitro* tests were performed using a 50 percent DDT wettable powder insecticide prepared by E. I. du Pont De Nemours and Co. and distributed under the trade name of "Deenate 50W".

The formulation of this water-dispersible powder is as follows:

95% by weight .... concentrate A
0.5 to 1% ..... wetting agent
1 to 3% ..... dispersing agent
1 to 3.5% ..... inert diluent
(du Pont dry concentrate A contains 53 percent technical DDT by weight)

One gram of Deenate dispersed in 99 ml of distilled water was used as a stock solution from which higher dilutions were made. A fresh solution was prepared monthly.

The milk samples were kept around 27°C for not more than 2 hours before being used.

Procedure

Ten-ml portions of (a) fresh poor quality, (b) fresh high quality and (3) week-old high quality raw milk containing various concentrations of Deenate (10, 100, 1,000 and 0 ppm, the controls) were added to test tubes holding 1 ml of a methylene blue thiocyanate solution. (The dye solution was prepared by dissolving one methylene blue thiocyanate tablet, approved by the Biological Stain Commission, in 200 ml of distilled water. Fresh dye solution were prepared weekly and stored in an amber bottle.) Each tube was inverted three times to insure uniform cream and dye distribution before it was placed in a 37°C water bath.

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TABLE 1 — THE INFLUENCE OF A DDT WETTABLE POWDER ON THE TIME REQUIRED FOR THE REDUCTION OF METHYLENE BLUE IN RAW MILK.

RAW MILK		DEENATE		REDUCTION TIME (HR.)							
Quality	Age	ppm		0.5	1	2	3	4	5	6	7
Low	Fresh	0	(control)	–	–	–	–	–	+	+	+
		10		p–	p–	p–	p–	p–	p+	p+	p+
		100		p–	p–	p–	p–	p–	p+	p+	p+
		1000		p–	p+	p+	p+	p+	p+	p+	p+
High	Week-old	0	(control)	+	+	+	+	+	+	+	+
		10		+	+	+	+	+	+	+	+
		100		+	+	+	+	+	+	+	+
		1000		+	+	+	+	+	+	+	+
High	Fresh	0	(control)	–	–	–	–	–	–	–	+
		10		p–	p–	p–	p–	p–	p–	p–	p+
		100		p–	p–	p–	p–	p–	p–	p–	p+
		1000		p–	p+	p+	p+	p+	p+	p+	p+

– no change in color of milk
\+ dye reduction
p– dye precipitation, milk decolorized slightly
p+ dye precipitation, milk decolorized completely

The colors of the samples were checked after 30 min incubation. Readings were then made at hourly intervals following the initial reading. The decolorized samples were removed from the water bath and the remaining tubes were inverted once. Decolorization was considered complete when 4/5 of the tube contents were white.

The effects of various concentrations of a DDT wettable powder on the time required for the decolorization of a methylene blue thiocyanate solution when added to low quality milk, milk of high quality but held for 7 days at 15°F, and milk of high quality but not stored, are shown in table 1.

RESULTS

The methylene blue in test (10, 100, 1000 ppm Deenate) and control samples (0 ppm Deenate) of week-old high quality raw milk was reduced within 30 min. The dye in the control samples in both low and high quality fresh raw milk was reduced after 5 and 7 hrs., respectively.

Blue colored particles precipitated in both fresh low and high quality raw milk containing Deenate as soon as they were inverted. The amount of precipitated material varied as did the Deenate concentration; small precipitates were found in samples containing 10 ppm Deenate and correspondingly larger precipitates occurred in samples containing 100 and 1,000 ppm. A corresponding reduction accompanied the dye precipitation; samples containing 1,000 ppm Deenate were completely decolorized within 60 min. Lower concentrations of Deenate did not appreciably affect the reduction time in the milk.

The addition of a small amount of Deenate, 10 ppm, to an aqueous methylene blue solution caused the dye to precipitate. This phenomenon failed to occur when pure DDT crystals were added to this solution.

DISCUSSION

The results seem to indicate that the presence of an appreciable quantity of a DDT wettable powder in raw milk materially interferes with the accuracy of the Methylene Blue Reduction Test. Deenate has been found to precipitate the dye in fresh raw milk before the natural reducing system of the milk (Thornton and Hastings,[10] or the reducing substances formed by the microorganisms in the milk (Hobbs,[5]) could affect a reduction of the methylene blue. Furthermore, the "active agent" of the insecticide, the DDT, did not cause the precipitation; the so-called "nnert constituents" were the responsible agents.

If more were known about the specific nature of these "inert constituents", it might be possible to postulate a mechanism to explain this phenomenon. There probably are several contributing factors, as many common wetting and and dispersing agents failed to precipitate the dye when used individually.

The significance of these observations is in the interpretation given the Methylene Blue Reduction Test run on fresh high grade milk containing significant amounts of Deenate. Milk of this sort might easily be mistaken for old or low grade milk. To obviate this danger, rapidly decolorized milk samples should be inspected for the presence of precipitates before final interpretations are made.

(continued on page 8)

MEMBRANE FILTER METHOD FOR DETERMINATION OF COLIFORMS IN PASTEURIZED AND CERTIFIED MILK

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The use of the membrane-filter method for determination of coliform organisms in pasteurized and certified milk permits a more rapid counting of coliform colonies with the elimination of much of the plating procedure used with the conventional determination methods. Results of analysis for coliform content can be preserved on the membranes for future reference. Large quantities of milk can be examined rapidly through the use of the centrifuge in the method outlined.

Endo-agar was used in this work as the differential agar medium.

INTRODUCTION

THE COLIFORM ORGANISMS, principally the species belonging to the *E. coli* and *A. aerogenes* groups, include the aerobic and facultative anerobic, non-spore forming and Gram negative bacteria, which ferment lactose with formation of gas and acid. These organisms are found almost any place in nature and they grow in the soil, on feed, on floors, intestinal tract of animals and man, etc. As lactose fermenting, they will grow rapidly in milk or cream and also in residual amounts of milk products left in the production or manufacture utensils. Being so widely present in the environment of the dairy farm and plant, it is not surprising that they are commonly present in raw dairy products.

The non-spore forming coliform organisms are mostly destroyed during pasteurization.[3,6,15,16] However, some strains may survive these temperatures. The organisms may also gain the entrance to the finished product directly from various sources during processing such as cracks and crevices in equipment, ineffective sterilization of equipment, or indirectly by hand or air contamination. When once in milk, they may grow and multiply under optimal conditions. The presence of coliform bacteria does not necessarily indicate a health hazard as they are not pathogenic[12] nor does it necessarily indicate contamination with fecal material. The relative numbers in a product may, however, indicate the care and sanitation exercised in handling and processing.

In recent years, various states have developed standards on the number of coliforms permitted in pasteurized milk.[1,13] The City Health Departments of Chicago, Columbus, and Buffalo have established and are now enforcing standards of a maximum of 10 coliforms in 1 ml milk. This standard is recommended by the U.S. Public Health Service in their forthcoming ordinance and code.[13] The City of New York has special standards for summer — 2 coliforms in 1 ml — and for winter milk 0.3 coliform in 1 ml. Albany, N. Y. allows a maximum of 0.36 coliform in 1 ml pasteurized milk or 36 in 100 ml. Many other cities which until this time have had no standards are working to establish some. Various rigid coliform standards have already been established in Europe. Milk containing more than 30 coliforms in 1 ml cannot be sold in Germany as certified; in England, 100 ml of certified milk must not contain more than 10 coliforms, and grade A pasteurized milk cannot contain any coliforms.[4]

HISTORICAL

The identification and isolation of coliform organisms is usually made with two bacteriological tests; the presumptive and the completed.[14] These procedures require considerable time and a large amount of bacteriological equipment, especially to properly evaluate quantitatively the number of coliforms present in pasteurized milk. The membrane-filter method to be described, has the advantage of showing on one petri dish the number of coliforms present in a large amount of milk.

The membrane-filters were first used to determine the number of coliforms in water.[2,5,7,9,10,11] The purpose of these experiments was to obtain on one membrane disc the

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He has published two papers in the Dairy publications of Germany and was the co-author of a paper presented before the 12th International Dairy Congress, held at Stockholm, Sweden in August, 1949.

Dr. Ehrlich arrived in the United States in August 1949 and secured a position as laboratory director of the American Butter Institute.

bacteria present in a large amount of water, and simultaneously to avoid using of a large amount of bacteriological equipment. The results of these water tests were satisfactory; the *E. coli, A. aerogenes, Typhus* and *Paratyphus* group bacteria, genus *Eberthella* and *Salmonella* were easily cultivated and showed good growth on the membrane filters, using standard differentiation agar as medium, while at the same time other bacteria were hindered in their development.

The membrane-filter exists in a very thin and uniform collidal form, which is made from cellulose or from cellulose esters with pores 1.5 to 0.5 microns wide. The filters are white and the surface is smooth and shining. They are resistant to 20 percent H_2SO_4 solution, 20-25 percent HCl solution, 25 percent Nitric acid solution and 1 – 3 per cent NaOH solution. The membrane-filters can be used only for filtration of water and water solutions, and are not resistant to organic solvents or solutions, such as ether, chloroform, acetone, etc. However, they can be washed for a short time with diluted alcohol.[8] The filter is best preserved in distilled water, containing a few drops of disinfectant.

EXPERIMENTAL

After experiments for determination of coliforms in water, the following method was developed for testing pasteurized milk to determine coliform organism content using the membrane filters.

A. Equipment.

1. *Vacuum filter.* The filter apparatus consist of a 1000 ml filtering flask with a rubber stopper and a Buchner type funnel with or without fritted disc. Also a Morton filter apparatus or any suitable bacteria filter apparatus can be used.

2. *Membrane filter.* Membrane filter by R. Zsigmondy obtained from Membranefiltergesellschaft, Sartorius-Werke A. G., Goettingen, Germany, were used for the experimental work.

3. Petri dishes, differential agar for coliforms, cotton, and alcohol.

B. Sterilization of the bacteria filter apparatus.

A swab of cotton is dipped in alcohol, ignited, and all parts of the apparatus sterilized with the burning cotton. It is best to work the vacuum pump simultaneously in order to sterilize the inside of the apparatus. The apparatus can be also sterilized in an autoclave.

C. Preparation of the membrane filters.

The filter must be boiled in distilled water for a period of 20 minutes. This operation will remove the disinfectant and the air contained in the pores and at the same time will adequately sterilize the filter. The pores will then be free for the capillary action and give free entry to the agar, so that the agar can cover the surface of the filters in a thin layer.

D. Preparation of milk samples.

Warm the milk sample to 40°C and centrifuge in sterile centrifuge bottle for 10 minutes at 2000-2500 rpm.

Draw off the milk and wash the remaining sediment with approximately 50 ml of distilled sterile water.

Shake vigorously and centrifuge as before.

Again draw off the water layer; dissolve the remaining sediment with about 100 ml of sterile distilled water and shake vigorously to break up the sediment particles.

E. Filtration.

The membrane filter is handled with sterile tweezers and placed on the filter apparatus plate. The entire surface of the membrane should rest on the filter plate, with the printed number up. Using vacuum, filter the dissolved sediment through the membrane. After the filtration is finished remove the membrane, dry the bottom carefully over a hot plate, and place on an agar plate, previously prepared by pouring approximately 10 ml of agar into sterile petri dish. The agar should be hard before use. In placing the membrane on the agar, avoid building up of air bubbles under the filter. To discourage the development of surface colonies, pour an additional 4 ml of agar over the surface.

RESULTS

After 24 hours incubation at 37°C the cultures on the filter are counted and reported as the number of coliforms in the amount of the initial material. The differentation of the coliform colonies from other bacteria, which are mostly hindered in their growth, occurs in the same way as in regular standard plating. Any kind of differential agar may be used as the medium; however, during these experiments the best results were obtained with the use of Endo-agar. The coliform cultures appear deep red, while the other colonies appear white. After the readings are made the membrane-filters may be dried in an oven at 60°C and preserved; no further growth will occur but the initial colonies remain intact.

The data in table 1 shows some of the results obtained by this method during the preliminary experiments. The milk samples were not commercially pasteurized, but pasteurized in the laboratory.

The gas tube test results are reported as a percentage of positive tubes of five tubes used for each dilution. Membrane filter results are reported as the average colony count of five membrane filters for each size sample of milk reported.

Sterile water blanks in place of milk samples were run under controlled laboratory conditions to determine the extent of possible contamination of a selected sample that could occur with the membrane method employed for coliform detection. Since all the sterile water blank examinations made showed

TABLE 1 — PRELIMINARY COMPARATIVE DATA

Sample	Percent of tubes showing gas develp. Brilliant-green bile				Number of colonies on membrane filters Endo-agar			
Ml of milk	1	10	50	100	1	10	50	100
Pasteurized milk	0	0	60	100	0.0	0.0	2.1	5.7
Pasteurized milk	40	100	100	100	2.0	8.1	27.0	TNTC
Pasteurized milk	0	0	0	40	0.0	0.0	0.0	1.8
Pasteurized milk	0	0	40	80	0.0	2.0	6.3	25.0
Certified milk	0	0	0	20	0.0	0.0	0.0	2.2
Certified milk	0	0	0	0	0.0	2.2	2.7	3.2
Certified milk	60	40	60	100	7.2	9.7	TNTC	TNTC
Certified milk	0	0	20	80	0.0	1.1	7.4	11.2

zero coliform, it was established to the satisfaction of the author that coliform content secured on milk samples tested was from the milk source and not a result of technique contamination.

SUMMARY

Preliminary work on the use of a membrane-filter method for determination of coliforms organisms is presented. This method permits more rapid counting of coliform colonies present and eliminates much of the plating heretofore necessary. The results of the counting can be preserved directly on the membranes for future reference. The use of the centrifuge in the method outlined permitted actual examination of large quantities of milk.

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THE CLEANING OF GLASS PIPING IN DAIRY PLANTS*

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The purpose of this study was to determine the relative efficiency of various chemical compounds used to clean permanently installed glass milk lines. Nine different commercial alkaline cleaners and four acid cleaners were selected.

To evaluate the effectiveness of each selected cleaner, a continuous thirty-day test was made at two dairy plants.

For purposes of comparison between physical (180°F hot water) and chemical sanitization, a study of some of the more commonly used chemical germicidal agents was included.

The nine commercial alkaline cleaners adequately cleaned Pyrex brand glass pipe but all quaternary-ammonium compounds used in this study were unsatisfactory either as cleaners or sanitizers.

Review of Preliminary Studies

The October 1950 issue of *Food Industries* reported a preliminary survey of the use of Pyrex brand glass piping in fluid milk plants. The results of this survey indicated that Pyrex brand glass piping might have a real place in dairy manufacturing plants and that it merited more closely controlled research in cleaning methods and costs.

At first many dairymen interested in adopting glass piping met with opposition from health authorities to the in-place cleaning of the pipe. These objections arose from fear of improper sanitation and because of the lack of scientific data as to soil and bacterial removal obtained by the various in-place cleaning methods; such objections were difficult to refute.

In some cases objections were based on local health regulations which required that sanitary pipe be disassembled daily for cleaning. In other instances, although the law did not explicitly require daily disassembly, the sanitarians insisted upon this procedure.

The need for scientific data relating to the sanitary condition of glass piping cleaned in place was made evident by requests from health authorities as well as from dairy plant owners and operators. Thus a study was undertaken at Cornell University in June of 1949 to determine the sanitary condition of glass piping which is cleaned in place by the recirculation of a cleaning solution, as compared to stainless steel sanitary pipe which has been dismantled, cleaned, and reassembled after each day's operation.

In carrying out this study, two glass-pipe lines were permanently installed at the Cornell University dairy plant at Ithaca, New York, and two were installed at the Geneva Milk Company plant at Geneva, New York. The cleaning and sanitizing of these two lines was done under actual plant operating conditions for a period of nine months.

The report of the results of the Cornell study, which includes the four lines mentioned above and several other glass line installations from other dairy plants, was made by Fleischman *et al.*[1,2] in 1950. The conclusions of the authors may be summarized as follows:

1. Pyrex glass-pipe cleaned in place can be kept bacteriologically as clean or cleaner than stainless steel sanitary pipe cleaned in the usual manner.

2. Pyrex brand glass is advantageous in that the plant operator can see visible deposits which might appear in milk pipelines, and he can also see if they have been cleaned.

3. The data indicated that there was no bacterial build-up at the gasketed joints of glass pipe-lines which were in use for nine months at Cornell and Geneva and for over two years in most of the plants surveyed.

4. The results showed that the stainless steel adaptors, which rigidly hold each end of the glass and which are cleaned in place, are no more a source of contamination of milk than is any other stainless steel pipe in the plant.

5. Glass pipe caused no measurable increase in the bacterial count of milk passing through it.

It is noteworthy that the results of the first nine months of investi-

Dr. Frederick F. Fleischman, Jr., the co-author of this paper, was graduated from Cornell University in 1949 and received his Ph.D. from Cornell in 1951. He and Dr. Holland spent 2 1/2 years studying both the sanitation and economic aspects of the use of Pyrex glass pipe in dairy plant operations. From 1948 to 1951 he was an instructor in the Department of Dairy Industry at Cornell, and is now employed by the Plant Equipment Sales Department of the Corning Glass Works.

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gation at Cornell closely parallel the findings of Dr. A. C. Fay and his associates at H. P. Hood & Sons Company to Boston, Massachusetts.

Dr. Fay has had an excellent opportunity to become familiar with all aspects of the care, sanitation, and use of glass lines, since the Hood Company has been using glass pipe in increasing amounts since 1944. They now have over one-half a mile of Pyrex brand glass piping in their Boston plant. This glass piping has been in continuous service for transporting raw milk, hot milk, and cold pasteurized milk.

In a paper given at the University of Illinois, January 1950, Dr. Fay[3] reported on swab tests* and rinse counts** that were made periodically by the research department of H. P. Hood & Sons Company on the glass elbows used in their many lines. Dr. Fay summarized these data as follows:

Swab Test*

"1. There are no significant differences between the counts on the pasturized and raw milk lines.

2. Four hundred eighty-four swab samples or 26% showed no growth.

3. One thousand six hundred swab samples or 86% showed plates with not over two colonies each (within the limits of experimental error).

4. One thousand eight hundred and two swab samples or 96.9% showed plates with not over 5 colonies each.

5. Only 58 swab samples or 3.1% showed more than 5 colonies each."

Rinse counts**

"1. Sixty out of 323 samples or 18.6% showed no growth.

2. One hundred seventy-eight out of 323 samples or 55.1% showed not over one colony each.

3. Two hundred fifty-six out of 323 samples or 79.2% showed no more than two colonies each, which is within the limits of experimental error.

4. Three hundred three out of 323 samples or 93.8% showed not over 5 colonies each.

5. Only 20 samples or 6.2% showed more than 5 colonies per plate."

In addition to the investigations at Cornell University and at the research laboratory of the H. P. Hood & Sons Company, J. J. Sheuring and H. B. Henderson[4] have issued a preliminary report giving the results of a study of the sanitation of a glass raw milk line at the University of Georgia. Although the results of the rinse counts of these two workers are not directly comparable with Dr. Fay's work because of different techniques employed***, the Georgia workers' investigations represent an interesting aspect of glass-pipe research not included in any of the reports previously cited. At the October 1950 meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS at Atlantic City, New Jersey, Dr. Sheuring made the following statements:

"1. Glass pipes will easily withstand sudden changes of temperature from 40°F. to 130°F. Higher temperatures have been used for wash water in some instances.

2. The glass pipes were not completely disassembled for eighteen months, when the gaskets were removed in order to show them at this meeting. Data are given on page 12 that indicate the glass pipes can be washed and sanitized effectively by washing with a solution of trisodium phosphate and sterilizing with chlorine.

3. After eighteen months of use, no glass pipes have been broken and no replacements have been necessary.

4. One set of sulfur-free rubber gaskets were used for eighteen months. No trouble was encountered at any time with leaky gaskets. No evidence was obtained that indicated than any seepage occurred between the gaskets and the glass.

5. Glass pipes are certainly adaptable for receiving cold milk in the modern dairy.

6. The expense of installing glass pipes is less than stainless steel. The labor involved in washing and sterilizing the pipes in almost negligible.

7. In this study no breakage has yet occurred so the replacement factor has been insignificant.

8. Glass pipes should be so arranged, especially in the small dairy, that a closed circuit is obtained for washing and sterilizing.

9. The longest pipe in the installation does not exceed ten feet in length. Short pipes are satisfactory for use in small dairies.

10. Continued washing and sterilizing of the pipes, as used in this study, do not discolorize the glass pipes.

11. After eighteen months of use, practically no milkstone exists on the glass pipe."

CLEANING COMPOUND RESEARCH

While the results of these initial investigations represent an important contribution, their main effect has been to stimulate interest in the further use of glass pipe throughout the dairy industry. This interest has raised many questions

*The glass elbows were removed and usually six swab samples were taken, three swabs from each of the two ends of the elbow. The swabs were rinsed in 10 cc of isotonic salt solution. One cc of this sample was plated.

**After rinsing the glass elbows with 100 cc of sterile water, 1 cc of the rinse water was plated.

***In the Georgia study, 10 gallons of sterile water were circulated through the glass line after sanitization. This water was then plated to determine the bacterial count per cc of water after circulation.

left unanswered by the aforementioned investigations. In an attempt to solve some of these problems, it was decided to continue and expand the Cornell investigation.

The first portion of this study was set up to determine the relative efficiency of various chemical mixtures used to clean permanently installed glass milk-lines. Since alkaline cleaners are less expensive and more commonly used in the dairy industry than are acid cleaners, the major portion of the work was done with the alkaline products. Nine different commercial alkaline cleaners and four acid cleaners were selected for the study. They varied considerably in composition but may be considered to be representative of many of the better commercial products now on the market.

Since water hardness exerts an influence on the action of cleaners, two milk plants using water of different hardnesses were selected for the purpose of this study. One was the milk plant at Cornell University with a water supply of approximately five grains per gallon hardness, and the other the Geneva Milk Company plant at Geneva, New York, with a water supply of between 14 and 17 grains per gallon hardness.

To evaluate the effectiveness of each selected cleaner, a continuous 30-day test was made at both plants on each of six of the alkaline cleaners, while the remaining three alkaline and the four acid cleaners were used at one of these plants only, with each test being conducted for the same period of time. The tests of the alkaline products were made on 1 1/2-inch glass pipe lines, transporting both raw and pasteurized milk; whereas, the acid products were used to clean a 1 1/2-inch glass holding tube on a high-temperature short-time pasteurizer.

(The velocity at which the cleaning solutions were circulated in these lines ranged from one foot per second to 10 feet per second.)

The cleaning procedure used for testing the alkaline products was as follows:

1. The system was rinsed with water at 100°F to 110°F until the water flowed clear.

2. Valves and fittings were brushed with cleaner solution.

3. The alkaline cleaning solution was circulated (at the concentration recommended by the manufacturer) for 10 to 15 minutes at 130°F to 150°F.

4. The cleaning solution was rinsed from the system with water at 65°F to 100°F until this rinse water flowed clear.

This procedure is the same as that recommended by the glass manufacturer with but one notable exception in step three. It is normally recommended that a sponge—made from natural or synthetic material and of a size ranging from 2 1/2 to 3 times the diameter of the pipe to be cleaned—should be pumped through the pipe line twice during the circulation of the cleaning solution. This step in the cleaning procedure was intentionally omitted to facilitate observations on the ability of each cleaning compound to remove visible soil from the line under study.

The following cleaning procedure was used for testing the acid products on the glass holding tube of the high-temperature short-time pasteurizer.

1. The machine was flushed with cold water.

2. Valves and fittings were brushed with the acid solution.

3. The acid cleaner was circulated (at the concentration recommended by the manufacturer) for 30 minutes at 140°F to 160°F.

4. The machine was flushed with hot water at 160°F for 5 minutes.

5. Alkaline cleaning solution at a concentration of 2 pounds to 25 gallons of water at 140°F to 160°F was recirculated for 20 minutes.

6. The unit was flushed with cold water.

7. Bactericidal solution was circulated through the machine for 20 minutes.

8. The machine and holding tube were drained.

In addition to the alkaline and acid cleaners, three quaternary-ammonium cleaner-sanitizers were tested to determine their relative cleaning efficiencies. It was originally intended to study each of these for a 30-day period but this became impossible because of the excessive surface film which was built up inside the glass pipe line and, as a consequence, the period had to be shortened to 15 days.

At regular intervals during the test period of cleaning with each product, the lines were examined for visible soil, milkstone, or other deposits on both the inner surface of the glass tubing and on the rubber interface gaskets between each section of tubing. The first method of examination tried was the use of an ultraviolet light emitting a wave-length of 3660A° which was directed into the open end of the glass tubing. Milkstone, if present, should fluoresce when exposed to this light. This method was not satisfactory because the light could not be directed against the inner surface of the pipe, and thus visual inspection was relied upon to detect any film build-up.

To prevent any carry-over of milkstone or other soil on the inner surface of the glass from one 30-day test period to the next, an acid cleaner was used in place of the alkaline cleaner for two days before testing a new material. During this treatment a sponge was circulated with the acid cleaner.

Following the cleaning and sanitizing of the milk lines, swab samples were taken from the inside surface of the glass and interface gaskets, and plated to determine

the total bacterial and the coliform counts. The swabbing technique, buffer solution, and media used have been previously described by the authors,[1] with the exception that when bacterial counts were to be obtained from lines sanitized with the hypochlorite agents, the buffer solution was modified by the addition of 0.5 gram of sodium thiosulphate per liter of buffer. This served to counteract the residual chlorine which might be picked up by the swab from the glass surface.

STANDARDS

Before any appraisal could be made as to what constituted satisfactory sanitization some arbitrary standard was needed. It is generally agreed that a milk container is satisfactorily sanitized when it does not contain more than one organism per milliliter of content. This was adopted as the standard for satisfactory sanitization in this study.

The area swabbed was approximately one inch long for each pipe size studied. The volume in milliliters of the pipe included for each swab was calculated from the pipe diameter. This milliliter figure was used as a standard and the figures are shown in table 1.

TABLE 1 — SUGGESTED STANDARDS FOR SATISFACTORY SANITIZATION OF GLASS PIPE LINES

Pipe size	Bacteria per inch swabbed
1"	13
1 1/2"	30
2"	50
2 1/2"	80
3"	115
4"	200

Most of the criticism of the in-place cleaning of glass lines has been directed toward the rubber interface gaskets which is used when two sections of glass are fastened together. To provide a more adequate analysis of the sanitization of glass lines, one swab sample was obtained from the gasket for each swab taken from the glass. In reporting the data, therefore, if the glass plus the adjacent gasket had a total count above that of the standard, *both* samples were reported as *above* standard. By using this method of reporting the data, the point was most susceptible to contamination, the gasket, was given equal weight with the glass line to which it was adjacent. Thus even though the swab obtained from the glass was sterile, if the swab obtained from the gasket was above the standard, both samples were reported as being above standard.

Swab samples were obtained from stainless steel sanitary pipe both at Cornell and Geneva where the pipe had been disassembled, cleaned, reassembled, and sanitized, according to the usual procedures. Such samples provided a basis for comparison between the two types of sanitary piping.

Additional swab samples were obtained from the stainless steel adaptors which fasten securely each end of the glass line. These adaptors are short sections of stainless steel sanitary pipe, and are cleaned in place by the same methods used on the glass. This provided a limited comparison between the sanitizing of permanently installed glass piping and permanently installed stainless steel sanitary piping.

EXPERIMENTAL RESULTS AND DISCUSSION

Cleaning Compounds

Although the nine alkaline cleaners varied widely in composition, no differences in their cleaning action or efficiency were noted during the course of this experiment. There was no case of any milkstone, film, or other visible soil deposits built up on the glass lines during the 30-day period in which each compound was used.

The four acid cleaners were used to clean a 1 1/2-inch glass holding tube on a high-temperature short-time pasteurizer. This glass holding tube was never dismantled except for inspection during the experiment. The glass, cleaned according to the procedure outlined previously, appeared clear and bright at all times regardless of the acid cleaner used.

Experimental Procedure

The original work by Fleischman *et al.*[2] showed that glass milk lines can be satisfactorily sanitized by the recirculation of hot water (above 185°F) or the flowing of steam through these lines for 5 minutes. For purposes of comparison between physical and chemical sanitization, a study of some of the more commonly used chemical agents was included.

For this phase of the study, three hypochlorite compounds and four quaternary-ammonium compounds were selected. Two types of quaternary-ammonium compounds were employed. The first was a straight aqueous solution used solely as a sanitizing agent, and the second was a group of three quaternary-ammonium detergent sanitizers which had been compounded with complex phosphates and other alkalies or with organic acids.

Each of the hypochlorite compounds and one of the quaternary-ammonium compounds circulated for 5 minutes, at 100°F, at a concentration of 200 parts per million. Each of these compounds was tested separately for a continuous 30-day period.

The three quaternary-ammonium detergent-sanitizers were used alone as the sole cleaning and sanitizing agent after the lines had been thoroughly rinsed. These three compounds were the ones tested for the 15-day period, as previously mentioned.

Sanitization

The bacterial counts which were obtained in these studies are shown in table 2. Those from the stainless steel sanitary pipe which was dismantled, cleaned, reassembled, and sanitized with hot water are given in column 1. Column 2 presents

TABLE 2 — RESULTS OF BACTERIAL COUNTS OBTAINED FROM STEEL AND GLASS SANITARY PIPE USING DIFFERENT SANITIZERS

Columns	1	2		3		4		5	
Type of sanitizer used	Hot water	Hot water		200 ppm chlorine (Compound #1)		200 ppm chlorine (Compound #2)		200 ppm chlorine (Compound #3)	
	Stainless steel control samples	Steel adaptors	Glass + gaskets	Steel adaptors	Glass + gaskets	Steel adaptors	Glass + gaskets	Steel adaptors	Glass + gaskets
No. of samples	92	132	801	20	90	16	96	16	96
No. of sterile samples	23 (25%)	55 (42%)	225 (28%)	13 (65%)	48 (53%)	9 (56%)	39 (41%)	8 (50%)	33 (34%)
No. of samples above standard	37 (40%)	30 (23%)	24 (3%)	1 (5%)	0 (0%)	4 (25%)	6 (6%)	1 (6%)	3 (3%)
No. of *coli* positive samples	6	2	0	0	0	0	0	0	0

Columns	6		7		8		9	
Type of sanitizer used	200 ppm quaternary ammonium solution (Compound #4)		200 ppm quaternary ammonium solution (Compound #5		200 ppm quaternary ammonium solution (Compound #6)		150 ppm quaternary ammonium solution (Compound #7)	
	Steel adaptors	Glass + gaskets	Steel adaptors	Glass + gaskets	Steel adaptors	Glass + gaskets	Steel adaptors	Glass + gaskets
No. of samples	16	96	34	132	8	48	10	48
No. of sterile samples	12 (71%)	39 (41%)	18 (53%)	45 (34%)	5 (62%)	9 (19%)	2 (20%)	6 (13%)
No. of samples above standard	0	9 (10%)	6 (18%)	24 (18%)	2 (25%)	18 (38%)	4 (40%)	36 (75%)
No. of *coli* positive samples	0	0	1	0	2	14	2	2

the bacterial counts of the glass piping which had been cleaned and sanitized in place with hot water.

It should be noted that although there was only a slight difference in the percentage of sterile samples between the glass and the stainless steel pipe lines, there was a considerable difference in the percentage of samples which had bacterial counts above the standard outlined in table 1. The glass pipe which was cleaned and sanitized showed only 3 percent of the samples above the standard, whereas the stainless steel sanitary pipe which had been dismantled, cleaned, reassembled, and sanitized, according to the usual procedure gave 40 percent of the samples above the standard.

Columns 3, 4, and 5 show the results obtained when three different hypochlorite solutions were used as sanitizing agents. The data in these three columns indicate that there was little or no difference in the germicidal efficiency of the three compounds. When the results are compared with results obtained using heat as the sanitizing agent, there are again only slight differences. This would indicate that either hot water or a 200-parts-per-million solution of hypochlorite will satisfactorily sanitize glass pipe lines.

The results obtained using a quaternary-ammonium sanitizer only (compound #4) are shown in column 6. This compound was used at a 200-parts-per-million concentration after the glass line had been washed with a good alkaline cleaner and thoroughly rinsed. The bacteriological results obtained compare favorably with the results obtained while using either hot water or a 200-parts-per-million hypochlorite solution. From a practical standpoint, however, this compound was unsatisfactory because a film was built up on the inner surface of the pipe and gaskets before the end of the 30-day test period.

The results obtained when using two alkaline detergent-sanitizers (compounds #5 and #6) at a quaternary concentration of 200 parts per million to clean and sanitize the glass lines are given in columns 7 and 8. Not only were the bacterial counts in the glass lines higher in both cases than the

counts obtained when other sanitizers were used, but in addition a brownish white film began to build up on the inner surface of the glass after only a few days of use. This became so pronounced after 15 days that the use of the detergent sanitizers was discontinued. This film may, in part, explain the higher bacterial counts.

Dr. P. R. Elliker,[5] of Oregon State College, reported after working with quaternary-ammonium detergent-sanitizers that the brown precipitate which developed might have represented an interaction between the quaternary and the milk proteins. He further reports that the proper rinsing of dairy equipment prevented this precipitate from forming. In line with Dr. Elliker's findings, as soon as the film first appeared on the glass lines, special precautions were taken to have these lines properly rinsed before the detergent-sanitizer was used. This special rinsing had little effect, however, and the precipitate continued to form on the glass surface.

One acid detergent-sanitizer was included in the study, and the results obtained from its use at a concentration of 150 parts per million, according to the recommendation of the manufacturer, are shown in column 9 (compound #7). This compound gave even poorer bacterial counts than the alkaline products, and the formation of the precipitate was just as pronounced.

It is interesting to note that when heat or hypochlorites were used for sanitization, the percentage of samples above the standard was consistently higher for the stainless steel adaptors than for the glass piping. This would indicate that the glass is more readily sanitized by these two media than was the stainless steel. This appears to contradict the findings of Moore,[6] at Illinois, who, when working with both glass and stainless steel sanitary pipes cleaned in place, reported that there was very little difference in the bacterial counts between the surface growth on glass and on stainless steel of different polishes. He reported, however, that some stainless steel sections developed leaky joints due to improper seating of the gaskets which resulted in "numerous milk remnants" being picked up by the swab and causing extremely high counts. His omission of these high-count samples from his tabulation would account for some of the discrepancy between this study and his work.

Since the stainless steel adaptors which are at each end of the glass lines are exposed to the air, there could possibly have been some bacterial contamination from this source which might in part explain some of the differences between the bacterial results on the glass and those on the steel adaptors.

In the trials in which the quaternary-ammonium compounds were used, the stainless steel adaptors had a smaller percentage of samples above standard that was found on the glass. This might be accounted for by the fact that the brown precipitate formation was not so extensive on the steel as on the glass. This would seem to indicate that there is an attraction between the quaternary and the glass causing this precipitation which might not occur between the quaternary and the stainless steel.

SUMMARY AND CONCLUSIONS

1. The nine commercial alkaline cleaners, which are representative of the better cleaners now on the market, adequately cleaned physically and bacteriologically Pyrex brand glass piping when used in accordance with the manufacturers' recommendations.

2. Each of the four acid cleaners studied satisfactorily cleaned the glass holding tube on the high-temperature short-time pasteurizer. These were used in conjunction with an alkaline cleaner.

3. Either water above 185°F or a 200-parts-per-million hypochlorite solution circulated for 5 minutes satisfactorily sanitized Pyrex piping cleaned in place.

4. All quaternary-ammonium compounds used in this study were unsatisfactory either as cleaners or sanitizers as they gave higher bacterial counts than either hot water or hypochlorite solution, and built up films on the inner surface of the glass pipe and gaskets after short periods of use.

5. Glass piping, cleaned and sanitized in place, gave consistently lower bacterial counts than stainless steel sanitary pipe cleaned by daily dismantling, cleaning, reassembling, and sanitizing.

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STUDIES ON THERMAL METHODS OF MEASURING THE HOLDING TIME IN HIGH-TEMPERATURE SHORT-TIME PASTEURIZERS

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Data are presented on the properties of thermal waves produced by several means of suddenly increasing or decreasing the temperature of the fluid moving through the holding tube of a high-temperature short-time pasteurizer. Thermal holding-time measurements made with eight instruments or methods are compared with the holding time measured by the 3-A standard salt test. The reasons for variation in the correction factor, the difference beween the holding times measured by the salt test and a thermal test, are discussed.

THE MEASUREMENT of holding time by thermal methods involves rapidly changing the temperature of the fluid being pasteurized and then, with sensitive temperature-measuring devices, noting the first appearance of fluid with other than the normal pasteurizing temperature at the inlet end of the holding tube and again at the outlet end of the tube. The time interval involved is taken as a measure of the holding time. These methods offer an advantage over the salt test since they can be used while the pasteurizer is being oprated on milk.

There are many methods and instruments available for the thermal type of holding-time measurement. Unfortunately, the results obtained with the various methods do not always agree, nor do they agree with the results obtained with the salt test. In many respects this is similar to the situation which existed before the method of using the salt conductivity test was standardized. The work reported here was undertaken to study as many as possible of the factors having an influence on the results of a thermal holding-time measurement.

EXPERIMENTAL

Most of the recording instruments used as thermal timers have electrically-operated chart drives and some use an electronic circuit for temperature measurement. The functioning of such an electronic instrument when powered by a supply subject to voltage variations was one of the suggested topics for investigation. The chart-drive mechanism on a typical electronic timer with a four-minute chart drive was checked by using a stop-watch to time the period for the chart to revolve through 60 seconds at various applied voltages. The timer was plugged into a "Variac" and the applied voltage was checked with a voltmeter. The results of the tests are given in table 1.

The consistency with which this instrument responded to a sudden change in temperature was also checked at various applied voltages. A simple measure of the consistency of the response was to measure the time for the recording pen to go from 155° to 165°F when the bulb at room temperature, was plunged into a well agitated water bath at 170°F. This instrument used resistance-type sensing elements and the temperature range covered was 155° to 170°F. The average results of five trials at each voltage are given in Table 2.

These results indicate that the chart speed of this instrument is not affected by line voltage variations down to about 50 volts and that the speed of response of the recording thermometer is nearly constant down to about 80 volts. A study of the individual values

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TABLE 1 — VARIATION OF CHART SPEED WITH APPLIED VOLTAGE

Applied voltage, volts	60-second chart interval as timed by stopwatch, seconds
110	59.9
100	59.9
90	59.9
80	59.8
70	59.9
60	59.8
50	59.3
40	Motor failed to move chart

TABLE 2 — VARIATION OF RESPONSE TIME WITH APPLIED VOLTAGE

Applied voltage, volts	Time for recorded temperature to go from 155° to 165°F, seconds
110	4.7
100	4.4
90	4.3
80	4.1
70	6.1
60	26.1
50	Pen failed to indicate any change

averaged to obtain the data for Table 2 indicates that there is no significance to the slight decrease in response time between 110 and 80 volts. The significant change does occur between 70 and 80 volts.

Properties of thermal waves

The electronic timer was next used to study the properties of thermal waves generated by various manipulations of the steam supply to a Cherry-Burrell high-temperature short-time pasteurizer with a rated capacity of about 3,500 pounds of milk per hour. During these tests the pasteurizer was operated on water at about 3,000 pounds per hour.

The holding tube on this unit consisted of 26 feet of 1½ inch Pyrex brand glass pipe. The necessary steam for heating purposes was supplied to the unit at about 75 psig through a 3/4-inch line. The flow of steam was controlled by a diaphragm valve.

The first method of producing a thermal wave was to by-pass the controls on the diaphragm valve in the steam line and to open the valve wide for five seconds. This permitted an extra charge of steam to enter the heating-water tank. The resulting changes in the temperature of the water being pasteurized were measured by the timer bulbs mounted on either end of the holding tube. This method gave a rate of rise in temperature of about 0.1°F per second at the bulb at the inlet end of the holding tube and a rate of rise of about 0.05°F per second at the bulb at the outlet end. The total rise in temperature at the first bulb was only about 0.3°F. The rise at the second bulb was often indistinguishable from slight temperature fluctuations naturally present in the system. It was not possible to make more than a very rough estimate of the holding time from charts made with this method of steam injection.

The timer used in these tests was equipped with a selector switch enabling one to record the temperature at either the inlet bulb or the outlet bulb. The procedure in making a holding-time measurement consisted of setting the switch to record for the first bulb, adding extra steam to the heating system and then, after the temperature at the first bulb showed a definite rise, switching to the second bulb. The time interval between the first appearance of the thermal wave at either bulb was the measured holding time.

An auxiliary 3/4-inch steam line was then installed to obtain a sharper thermal wave. The line ran from the main steam supply line, contained a manually operated quick-acting gate valve, and terminated in the heating-water tank just above the port from which water was drawn and pumped to the plate heater. Steam supplied through this line did not mix with the bulk of the water in the heating-water tank, as was the case in the previous tests. By opening the valve in this line for a few seconds, thermal waves causing relatively abrupt changes in temperature at both bulbs were obtained. The properties, as measured at both ends of the holding tube, of the thermal waves produced by opening this valve for different lengths of time are given in Table 3.

The figures given in the last two columns of table 3 are the time intervals between the first appearance of the thermal wave and the time when the temperature indicated by the bulb in question returned to normal. The rate of rise in temperature was calculated from the temperatures recorded during the interval immediately after the initial appearance of the thermal wave. For a short time after the wave appeared, the temperature increased at a uniform rate. The rates given in the table are for this period of uniform increase.

TABLE 3 — PROPERTIES OF THERMAL WAVES WHEN STEAM WAS INJECTED INTO HEATING-WATER TANK

Duration of extra steam injection, sec.	Total rise in temp., °F.		Rate of rise in temp., °F./sec.		Time for wave to pass, sec.	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1	0.7	0.5	0.2	0.1	14	17
3	2.1	1.6	0.3	0.2	19	25
5	3.5	2.4	0.4	0.3	27	32
7	4.5	3.2	0.4	0.3	32	37
9	5.5	3.9	0.4	0.3	40	41

TABLE 4 — PROPERTIES OF THERMAL WAVES WHEN STEAM WAS INJECTED DIRECTLY INTO HEATING-WATER LINE

Duration of extra steam injection, sec.	Total rise in temp., °F.		Rate of rise in temp., °F./sec.		Time for wave to pass, sec.	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1	1.7	1.1	0.5	0.2	36	39
3	3.6	2.5	0.8	0.4	36	42
5	5.6	3.8	1.0	0.5	42	48
7	7.4	5.0	1.0	0.6	48	54

The time at which the thermal wave reached either bulb could be estimated fairly accurately to within ± 0.5 second. Holding-time measurements were made by applying the extra steam for 1, 3, 5, 7, and 9 seconds. There was practically no difference in the readability of the charts and in each case the holding time indicated was between 22.5 and 23.0 seconds.

Next an additional steam line was installed which allowed injection of the extra steam directly into the hot water line at a point about six inches before the water line entered the final heating section of the pasteurizer. The line was of 3/4-inch pipe and the flow of steam was controlled by the same valve used in the previous tests. Properties of the thermal waves obtained with this setup are given in Table 4.

If, with this setup, the extra steam was applied for more than seven seconds, the resulting thermal wave caused an excessive amount of throttling on the part of the automatic steam controls. This sudden throttling of the steam supply often resulted in the temperature falling to the point where the system would go into diverted flow.

Although the charts showed sharper rises in temperature than those of the previous set, there was no appreciable increase in the ease of estimating the time at which the thermal wave reached either bulb. The holding time was estimated at 22.5 seconds in each case when extra steam injections of 1, 3, 5, and 7 seconds duration were used.

These results indicate the desirability of introducing the extra steam into the heating-water circuit as close to the plate heater as possible. Allowing this steam to mix with all of the water in the hot-water tank should be avoided if a sharp thermal wave is to be obtained.

Two methods were used to produce waves in which the changes in temperature were downward rather than upward. The first consisted of stopping the heating-water pump for a few seconds. The results of these tests are given in Table 5.

The holding times estimated from charts made by this method were between 23.5 and 24.0 seconds. The method, however, was quite unsatisfactory because the small and slow changes in temperature produced were difficult to read on the charts.

Cold waves were also produced by injecting various volumes of ice water into the holding tube. The injections were made through a 3-A standard salt-test electrode using a veterinary-type syringe. The salt-test electrode used for the injection port was mounted in one arm of a number 9 cross and a thermal bulb in an adjacent arm. The cross was used to replace the tee ordinarily located at the inlet to the holding tube. Temperature changes were measured and recorded with the electronic timer used in the previous tests. The results of the tests are given in Table 6.

In these trials, the holding times read from the charts varied inversely with the volume of ice water injected. The holding times were 21.5, 20.5, and 20.3 seconds for injections of 10, 25, and 50 cubic centimeters of ice water respectively.

Because the injection of the ice water was made so close to the first bulb, the properties of the wave recorded at this point are somewhat questionable. The drop in temperature was extremely rapid. However, it is probable that much of the ice water was able to pass the bulb so rapidly that the true drop in temperature was not recorded. The time at which this abrupt drop in temperature started

TABLE 5 — PROPERTIES OF THERMAL WAVES PRODUCED BY MOMENTARY STOPPAGE OF THE HEATING-WATER PUMP

Time pump off, sec.	Total decrease in temp., °F.		Rate of decrease in temp., °F./sec.		Time for wave to pass, sec.	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
3	0.2	0.2	0.05	0.05	14	23
5	0.4	0.3	0.1	0.05	42	49
7	0.8	0.5	0.15	0.1	44	47
9	1.2	0.8	0.15	0.1	47	54

TABLE 6 — PROPERTIES OF THERMAL WAVES PRODUCED BY INJECTING ICE WATER INTO THE HOLDING TUBE

Volume of ice water injected, c. c.	Total decrease in temp., °F.		Rate of decrease in temp., °F./sec.		Time for wave to pass, sec.	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
10	0.15	0.1	0.4	0.05	7	12
25	0.6	0.5	1.4	0.2	11	21
50	1.0	1.2	1.5	0.5	21	40

could be estimated to about 0.1 second. The time at which the wave reached the second bulb could be estimated to about 0.5 second.

Direct Comparison of Salt and Thermal Test

Both a salt-test electrode and a resistance thermometer bulb were mounted at each end of the holding tube. An injection of 50 cubic centimeters of iced, saturated salt solution was used to activate the thermal timer and also an automatic Solubridge flow timer connected to the salt-test electrodes. The holding times indicated by the two instruments agreed within about 0.3 to 0.5 second. The holding time indicated by the salt test was always the shorter of the two.

Alternate Method of Reading the Holding Time from the Recorder Charts

The holding time was ordinarily taken as the time interval between the first appearance of the thermal wave at the inlet and outlet bulbs. An alternate method of estimating the holding time was also tried. The method consisted of reading the time between the mid-point of the temperature rise recorded by the first bulb and the mid-point of the rise recorded by the second bulb.

The steady temperature at either bulb before the appearance of the thermal wave and the maximum temperature reached as the wave passed could both be read from the charts with accuracy. One-half the difference between these two temperatures recorded at the inlet bulb was added to the steady temperature before the appearance of the wave. A line at this new temperature was drawn through the recorded increase in temperature due to the thermal wave. These two lines intersected at nearly a right angle and the time corresponding to the point of intersection could be estimated closely. The same procedure was used for the temperatures recorded at the outlet bulb. The time interval between the two points of intersection obtained in this manner was taken as a measure of the holding time. This time was always slightly longer than the time interval between the points of initial changes in temperature at the two bulbs.

Charts were obtained by injecting steam, for five seconds, into the hot water line just before the plate heater of the Cherry-Burrell pasteurizer. The holding times estimated by both methods from each of nine charts are given in Table 7.

Although this alternate method did eliminate much of the guesswork in reading the charts, the ordinary method still seems the more desirable of the two. In addition to being the more logical way of interpreting the charts, the ordinary method gave holding time values closer to the true holding time.

Comparison of Various Instruments and Methods for Measuring Holding Time

These tests consisted of comparing the performance of various instruments designed for or adaptable to the measurement of holding time by thermal methods. Results obtained with the 3-A salt conductivity method were used as the basis for comparing the holding times indicated by the various instruments.

One set of tests was made using the instruments on the Cherry-Burrell pasteurizer in the University bottling plant. All thermal waves were generated by injecting steam, for 5 seconds at about 75 psig, into the hot-water line just before the plate heater. The pasturizer was operated on water during the tests.

TABLE 7 — COMPARISON OF HOLDING TIMES OBTAINED BY REGULAR AND ALTERNATE METHOD OF READING RECORDER CHARTS

Interval between initial temp. changes, sec.	Interval between mid-point of temp. rises, sec.
22.5	23.9
22.0	23.5
22.5	23.8
22.5	24.1
22.0	23.7
22.0	23.9
22.0	23.5
22.5	23.8
22.5	24.1
Mean 22.3	Mean 23.8

Another set of tests was made on an experimental pasteurizer. This unit consisted of a positive pump, a counter-current, tubular heat exchanger, and a 2-inch, box-type holding tube 24.4 feet long. In operation, about 6,200 pounds of water per hour were supplied to the heat exchanger at about 140°F and was heated to 160°F. The water then went through the holding tube and was discharged either to a tared receiver or to waste. Thermal waves were generated by injecting steam into the hot-water line going to the heat exchanger. A two-second steam injection was used since it gave a rise in temperature comparable to that obtained when the steam line to the Cherry-Burrell pasteurizer was opened wide for 5 seconds.

During each set of runs, conditions were kept as nearly constant as possible for each of the available instruments. The 3-A standard salt test was run on each of the setups using an automatic Solubridge timer.

The instruments or methods used to measure holding time by the thermal method were:

1. An electronic timer with resistance-type sensing elements, a single recording pen with selector switch, and a circular chart covering the range 155° to 170°F and making one revolution in 4 minutes.

2. Mercury in glass stem thermometers (-10° to 110°C) mounted at each end of the holding tube. The appearance of the thermal wave was noted by a sudden rise in temperature. The time was measured with a manually operated stopwatch.

3. Bi-metallic thermoregulators of 10-ampere capacity at 115 volts, connected in series with an electric light bulb and a selector switch. The regulators were set to make contact at the following temperatures:

For the experimental pasteurizer

Bulb 1	160.8°F
Bulb 2	162.0°F

Pasteurization temperature 159.5°F

For the commercial pasteurizer

Bulb 1	163.0°F
Bulb 2	163.2°F

Pasteurization temperature 162.2°F

Bulb 1 and bulb 2 refer to the sensing elements mounted at the inlet end and the outlet end of the holding tube respectively. The time was measured with a manually operated stopwatch.

4. A single-pen timer using vapor-pressure type sensing elements and a circular chart making one revolution in 30 seconds. The pen recorded at one level for bulb 1, and at another level for bulb 2. The pen jumped from level 1 to level 2 when the temperature at bulb 1 reached a preset level and returned to level 1 when the temperature at bulb 2 reached another preset level. The holding time was read between the two abrupt movements of the pen. The preset response points used were:

For the experimental pasturizer

Bulb 1	161.1°F
Bulb 2	160.9°F

Pasteurization temperature 159.5°F

For the commercial pasteurizer

Bulb 1	163.1°F
Bulb 2	163.1°F

Pasteurization temperature 162.1°F

5. A double-pen timer using vapor-pressure bulbs and a circular chart making one revolution per minute. Both pens recorded at the same level for normal operating conditions. The appearance of a thermal wave at bulb 1 caused the pen recording for bulb 1 to move upscale. The pen recording for bulb 2 moved downscale when the thermal wave reached bulb 2. Pen movement was in response to a sudden change in temperature rather than to the temperature having reached a selected response point. The holding time was the interval between the points where the up- and downscale movement of the pens started.

6. Vapor-pressure thermometer controllers used in a setup similar to that for the bimetallic regulators. The controllers were set to make electrical contact at 1°F above the normal temperature at the bulb in question in all tests.

7. Small resistance-type sensing elements connected to an automatic salt-test timer which responded to changes in resistance to the elements caused by the passage of a thermal wave.

8. Copper-constantan thermocouples connected to a recording strip-chart potentiometer with a chart speed of 8 inches per minute. A selector switch was used to permit recording the potential of either thermocouple, which changed abruptly on the appearance of the thermal wave.

The first five instruments or methods were used on both the commercial and the experimental pasteurizers. The rest were used on either one or the other. Method 8 was used on the commercial pasteurizer after the installation of a new, fixed speed pump. It was necessary, therefore, to work with this method at flow rates higher than those used with the other methods. All other conditions were the same as those prevailing when the other methods were tested. The results of these comparative tests are given in Table 8.

With the experimental pasteurizer, it was not possible to control the pasteurization temperature as closely as with the commercial pasteurizer. With those instruments having a preset response point, the holding time was influenced by the temperature existing in the holding tube during the run. A correction has been made for that part of the range in the measured holding times due to the slight variations in pasteurization temperatures when working with the experimental setup. This correction was calculated from the known rate of rise in temperature at each of the bulbs and the range in pasteurization temperatures measured during the series of twenty runs. This cor-

TABLE 8 — COMPARISON OF HOLDING TIMES MEASURED BY EIGHT DIFFERENT METHODS

Instrument or method*	Number of trials	Mean flow rate, lb. /hr.	Difference between highest and lowest meas. flow rate, % of mean	Range limits of measured holding times, sec.	Range, sec.	Part of range due to temp. variations, sec.	Mean holding time, sec.	Mean holding time corrected to flow rate for salt test, sec.	Difference between salt-test time and thermal-test time, sec.
				Commercial Pasteurizer					
Salt test	20	2749	2.1	22.13 – 22.58	0.45	–	22.34	22.34	0.0
1	20	2768	3.5	25.5 – 26.25	0.75	–	26.04	26.22	3.88
2	20	2814	3.5	24.7 – 27.0	2.3	–	26.07	26.69	4.35
3	20	2771	2.3	25.2 – 28.9	3.7	–	26.71	26.92	4.58
4	20	2672	1.8	30.8 – 31.9	1.1	–	31.25	30.35	8.01
5	20	2647	2.4	27.1 – 28.1	1.0	–	27.67	26.64	4.30
8	20	3329	1.0	20.6 – 22.6	2.0	–	21.6	26.15	3.81
				Experimental Pasteurizer					
Salt test	20	6207	1.4	13.73 – 14.06	0.33	–	13.91	13.91	0.0
1	20	6211	1.6	15.0 – 16.0	1.0	–	15.54	15.55	1.64
2	20	6217	1.0	14.9 – 16.3	1.4	–	15.56	15.58	1.67
3	20	6217	1.4	15.7 – 17.8	2.1	0.7	16.72	16.75	2.84
4	20	6247	1.4	16.7 – 17.1	0.4	0.1	16.93	17.04	3.13
5	20	6233	1.0	15.6 – 15.9	0.3	–	15.73	15.80	1.89
6	20	6199	0.1	16.1 – 17.9	1.8	0.4	16.94	16.92	3.01
7	20	6188	0.1	13.94 – 14.86	0.92	–	14.31	14.27	0.36

*A description of the instruments and methods is given in the text.

rection is indicated in column 7 of Table 8. The corrections are small since the greatest difference between the highest and lowest steady-state, or pasteurization, temperatures recorded during any set of runs was always less than 1°F.

With instruments having a preset response point, it is possible to vary the apparent holding time over relatively wide limits by appropriate choice of the response point. In some of the tests presented in Table 8, the instruments of this type were not set at response points which gave maximum sensitivity. When this was the case, the difference between the holding times measured by the salt test and by the particular thermal method in question was large. Quanitative data on this effect are given in a later section.

The data presented in Table 8 indicate that the difference between the holding times measured by the salt and thermal methods, or the correction factor as it is sometimes called, varies with the instrument used and with the pasteurizer being checked when considering one particular instrument. It appears that, without comparing the salt and the thermal tests under the particular conditions under which the thermal test was to be used, it would be extremely difficult to accurately predict what the correction factor should be.

Some of the instruments used in this work were extremely sensitive and quick to respond to a temperature change. The fact that all instruments showed a correction factor is of interest. It seems to confirm the logical assumption that there must always be some slight correction factor since part of the thermal wave is dissipated through the transfer of heat to the holding tbue itself. This dissipated part of the thermal wave cannot be detected regardless of the sensitivity of the thermal timer. When using a tracer method, such as the salt test, to measure holding time it is true that the salt becomes extremely dilute at the front of the charge but, it is still theoretically possible to detect the first trace of it appearing at the outlet end of a holding tube.

Effect of Flow Rate on Correction Factor

Tests were performed to determine how the correction factor would vary for a particular pasteurizer when the flow rate through it changed over fairly wide limits. The experimental high-temperature short-time pasteurizer was used for these tests. The holding time was measured by the salt test, with the thermal timers listed as numbers 1 and 5. The holding-time measurement is independent of the

TABLE 9 — EFFECT OF FLOW RATE ON CORRECTION FACTOR

Flow rate, lb./hr.	Holding time by salt test, sec.	Holding time by timer No. 1, sec.	Correction factor, sec.	Holding time by timer No. 5, sec.	Correction factor, sec.
4378	19.45	21.97	2.52	22.38	2.93
6207	13.91	15.55	1.64	15.80	1.89
7504	11.42	13.06	1.64	13.19	1.77

pasteurization temperature with both of these timers. The result of the tests are given in Table 9.

The results indicate a marked increase in the correction factor for flow rates lower than normal, whereas the correction factor remains nearly constant as the flow rate is increased above normal.

Effect of Pasteurization Temperature on the Correction Factor

When using an instrument with a preset response point, the apparent holding time will vary as the pasteurization temperature is raised or lowered. The following tests were run to determine the magnitude of such changes when using a typical instrument of the preset response-point type. Instrument No. 4 was used with both bulbs set to respond at 162.4°F. All tests were run with water in the experimental pasteurizer.

The pasteurization temperature was kept constant to within ± 0.1° F at four different levels between 159 and 162°F. The holding time was measured ten times at each temperature. The flow rate was measured for each run and holding times were corrected to a flow rate of 6207 pounds per hour, for which the salt test showed 13.91 seconds. The results are given in Table 10.

SUMMARY AND CONCLUSIONS

It was found that the operation of an electronic type of thermal timing instrument was dependable in spite of variations in its voltage supply between 110 and 80 volts. Below 80 volts the response to temperature changes became sluggish and at about 40 volts the chart-drive motor failed to operate.

The thermal waves used commonly consisted of slugs of overheated product moving through the holding tube. The time interval between the first appearance of this overheated slug at the inlet end again at the outlet end was taken as the holding time. An application of extra steam to the system was used to produce the wave and the properties of the wave varied with the method of applying this steam.

The injection of extra steam into the heating water tank resulted in an ill-defined thermal wave if this steam was allowed to mix with the bulk of the water in the tank. Injecting the steam into the heating water tank at a point directly above the suction port of the water circulating pump gave better results.

TABLE 10 — EFFECT OF PASTEURIZATION TEMPERATURE ON THE CORRECTION FACTOR

Temperature, °F	Holding time by thermal test, sec.	Correction factor, sec.
159	19.69	5.78
160	18.42	4.51
161	17.43	3.52
162	16.53	2.62

The most abrupt changes in temperature were obtained when the extra steam was introduced into the hot water line at a point just before the plate heater. In a commercial pasteurizer operating on water at about 3,000 pounds per hour, the introduction of extra steam at 75 psig for 5 seconds by either of the last two methods gave abrupt and easily measureable changes in temperature.

Thermal waves in which the changes in temperature were downward were also used. When these waves were produced by momentarily stopping the heating water pump, the changes in temperature were too small and too gradual to be detected with accuracy. Cold waves were also produced by injecting ice water into the holding tube. Relatively abrupt changes in temperature were produced by this method. However, the measured holding time varied inversely with the volume of ice water injected.

When 50 cubic centimeters of ice saturated salt solution was used to activate both a thermal timer and a Solubridge with sensing elements mounted adjacent to each other at either end of a 26-foot, 1 1/2-inch holding tube, the time indicated by the salt test was always about 0.3 to 0.5 second less than that indicated by the thermal test.

When reading the holding time from charts made by a timer which recorded temperature, the most convenient interval to take as a measure of the holding time was that between the first indication of change in temperature at each bulb.

Holding times obtained with eight different instruments designed

(continued on page 25)

QUATERNARIES AND HYPOCHLORITES IN MASTITIS SANITATION[1,2]

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A comparison of the relative merits of quaternaries and of hypochlorites for mastitis sanitation procedures — such as washing teat cups and udders — showed that both types of sanitizers were about equally effective.

CONFLICTING CLAIMS have raised a question in the minds of many dairymen regarding the relative merits of quaternaries and hypochlorites for mastitis sanitation procedures. A brief review of certain fundamental properties of the two types of germicides should indicate their relative advantages and limitations for the various sanitation steps involved. The specific steps in mind in this discussion include washing udders and teats before milking and dipping teat cups in germicidal solution between cows. Another step sometimes carried out consists of dipping the teats in a germicide solution after milking.

The purpose of each of the above sanitation procedures is obvious and needs no elaboration. The common etiologic agents responsible for mastitis also are well established. Among the most important are the group consisting of *Streptococcus agalactiae* and related species, *Streptococcus pyogenes*, *Micrococcus pyogenes* var. *aureus*, and *Micrococcus pyogenes* var. *albus*, *Aerobacter aerogenes*, *Escherichia coli*, *Pseudomonas aeruginose*, *Corynebacterium pyogenes*, and occasional other species of microorganisms. In spite of widespread antibiotic and sulfa therapy, the streptococci still are an important causative agent. The micrococci (staphylococci) and coliform species also frequently are responsible for serious infections. Much of the work carried out to evaluate sanitation procedures has utilized streptococci for test agents. The results in general, however, can be applied as well to the other bacterial species if individual characteristics of these are kept in mind.

PREVALENCE OF SOME CAUSATIVE AGENTS OF MASTITIS

Segregation of infected cows represents the first important step in mastitis sanitation. This usually has reduced incidence of new infections. The failure of segregation to arrest completely the spread of mastitis in dairy herds may be due in some cases to low-grade, mild infections that are not detected in normal appearing animals, and also to the difficulty of preventing spread of mastitis bacteria throughout the dairy establishment.

Spencer *et al.*[12] have shown that although *S. agalactiae* dies rapidly at normal temperatures, some cells may survive for several days on bedding, and the lower the temperature, the longer is the survival period. Bryan[1] was able to isolate *S. agalactiae* from bedding and dust of dairy barns. Other studies have indicated success in infecting cows with mastitis streptococci inoculated onto bedding.

In an interesting study on possible modes of infection of *S. agalactiae*, Harrison[3] was able consistently to isolate the streptococci from the hands of persons milking cows. He was unable to isolate the organism from hands of non-milkers such as office workers. He considered therefore that *S. agalactiae* was a member of the resident flora of milkers' hands. In a somewhat similar investigation. Spencer *et al.*[12] were able to isolate *S. agalactiae* from the hands of two men who were hand milkers of an extensively infected herd. They were unable to isolate the organisms from the hands of eight men who used milking machines in infected herds and handled the udders only during the washing and stripping processes.*

In most diseases one of the important factors determining whether infection occurs is the number of infective units waiting to invade the host. This undoubtedly is true of most mastitis infections, keeping in mind also the importance of in-

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[1]Paper presented at 38th Annual Convention, International Association of Milk and Food Sanitarians, Glenwood Springs, Colorado, Sept. 26-29, 1951.

[2]Published with the approval of the Director of the Oregon Agricultural Experiment Station. Contribution of the Department of Bacteriology.

*Another study on this problem with similar results is that by A. Chadkowski. The distribution of *Str. agalactiae* outside the bovine udder and its survival. *J. Comp. Path. and Therap.*, **59**, 275 (1949)

juries as a predisposing factor. The above observations then indicate that agents such as hands of milkers and teat cups of milking machines are a frequent cause of transmission and they emphasize further the importance of any sanitation measures that may at least reduce numbers of mastitis bacteria on such surfaces. This reasoning applies regardless of whether the infectious agent is S. *agalactiae* or some other organisms such as a micrococcus or coliform type.

Further substantiation is presented in the report of Spencer and Kraft[11] who followed incidence of infection in twelve herds in which chemotherapy was not practiced. Two herds considered to have satisfactory milking management from the sanitation standpoint showed a progressive increase in infection from 5.26 to 35 percent during the first four lactation periods and this increase then was followed by a decline. On the other hand, ten herds with poor milking management showed an increase from 60.61 to 72.73 percent during the first four lactations followed by a sharp increase. These workers concluded that large herds and poor sanitary practices were associated with high incidence of infection and the degree of exposure outweighed aging of the udder as a cause of increased infection with successive lactations.

Quaternaries and Hypochlorites for Udder and Teat Disinfection

Although the *in vitro* resistance of most mastitis bacteria to germicides is low[16], their destruction on skin surfaces such as the udder and teats is difficult. Spurgeon *et al.*[13] in a study of destruction of S. *agalactiae* inoculated onto teats of cows found that hypochlorites and quaternaries did not eliminate all the organisms present; however, by rinsing with 250 ppm of either quaternary or hypochlorite, it was possible to destroy about 90 percent of the cells that remained following a rinse with plain water. It also was observed that at least three successive vigorous scrubbings with 300 ppm hypochlorite were necessary to remove all hemolytic streptococci from teats of cows in these trials. In no case were all mastitis streptococci removed or destroyed by a single washing or dipping of teats. The same circumstances would be expected under practical barn conditions and it should be borne in mind therefore that no form of udder wash or teat rinse will destroy all mastitis bacteria unless the procedure is carried out repeatedly several times in succession. Such treatment of course would be impractical for any dairy farm. The significant fact developed in these studies, however, is that both quaternaries and hypochlorites will destroy large numbers of mastitis bacteria present, and any reduction of numbers present should reduce chances for infection accordingly.

Barn trials indicate that quaternaries and hypochlorites provide about equivalent destruction of mastitis streptococci applied to udder and teat surfaces. An average of twelve different tests with two of the more active quaternary and two representative hypochlorite preparations yielded the following percent destruction of S. *agalactiae* inoculated in large numbers in a milk suspension onto teats: Quaternary A. 90 percent; quaternary B, 95 percent; hypochlorite A, 91 percent; and hypochlorite B, 89.1 percent.[13] Nevertheless quaternaries are favored for this udder and teat washing because they usually result in less chapping and irritation of skin surfaces. This has been observed and commented on by many farmers and personal observation has indicated it to be an established fact. The difference in effect of quaternaries and hypochlorites usually is more noticeable in the colder months of the year. The same difference between quaternaries and hypochlorites has been observed with persons who wash or rinse their hands in germicide solution between cows or who wash the cows' udders with germicidal solution.

Concentrations of germicide recommended for udder and teat disinfection range from 200 to 300 ppm. Individual cloths or towels are recommended and if the same cloth is used on a number of cows precautions should be taken to provide fresh germicide solution after a number of animals are washed in order to maintain germicide strength and a clean solution. In some installations a germicide such as quaternary may be injected into the warm water spray used to wash cows udders and flanks before milking.

One study[7] suggests no effect on the final plate count of milk through use of a germicide in udder wash solutions. This would be expected, especially where cows are kept relatively clean. Nevertheless recommendation of a germicide such as quaternary for this procedure seems sound under practical operating conditions. Keith and Reaves[8] also have advocated use of quaternary ammonium compounds for this purpose.

Treatment of Teat Cups Between Cows

Results of a number of investigators.[1,5,9,10,15] have emphasized the difficulties involved in destruction of mastitis streptococci on milking machine teat cups. Effectiveness of hypochlorite and quaternary compounds for teat cup disinfection have been reported by Spurgeon *et al.*[14] In these controlled studies sterile teat cups were inoculated with milk suspensions of S. *agalactiae* and subjected to various treatments. Results of a portion of the trials are shown in tables 1 and 2. The results indicate that a brief but thorough rinsing with cool water followed by a rinse with either 200 ppm hypochlorite or quaternary germicide at 125°F may destroy all but a few of the mastitis streptococci. Complete disinfection by such a procedure is extremely difficult. Increasing the concentration to 500 ppm resulted in

TABLE 1* — COMPARATIVE EFFECTIVENESS OF: (1) A WATER PRE-RINSE PLUS FINAL GERMICIDE RINSE AND (2) GERMICIDAL PRE-RINSE PLUS FINAL GERMICIDAL RINSE IN DESTRUCTION OF S. AGALACTIAE ON TEAT CUPS

No. of trial	Germicide used	Control cup-no. organisms before treatment	Number of organisms recovered after treatment with: 70°F water then 125°F water	70°F water then 125°F germicide	70°F germicide then 125°F germicide
	H-A	1605	218	2	1
1	Q-A	1525	118	43	10
	H-A	1515	139	2	1
2	Q-A	1608	232	4	3
	H-A	1285	122	2	1
3	Q-A	1535	223	5	4
	H-A	1400	104	2	2
4	Q-A	1288	175	4	2

H — Hypochlorite
Q — Quaternary

*From data of Spurgeon, Harper and Elliker, *Milk Plant Monthly* **38**, 42 (Oct. 1949).

TABLE 2* — INFLUENCE OF PHYSICAL CONDITION OF TEAT CUP INFLATIONS ON DESTRUCTION OF S. AGALACTIAE BY 250 PPM HYPOCHLORITE AND QUATERNARY GERMICIDE SOLUTIONS

Trial	Type of inflation	H-A	H-B	Q-A	Q-B
			Number of organisms recover after water rinse and treatment with germicide:		
1	New	4	7	5	6
2	New	4	20	18	15
3	Old	116	72	260	225

H — Hypochlorite
Q — Quaternary

*From data of Spurgeon, Harper and Elliker, *Milk Plant Monthly* **38**, 42 (Oct. 1949).

more complete destruction than lower concentrations, but usually a few streptococci again survived. Results of table 1 indicate that merely rinsing with cool water before dipping in germicide solution removes large numbers of organisms inoculated by swabbing teat cups with a milk suspension. The two successive rinses in germicide solution were intended to determine effect of adding a germicide to the cool water in the first rinsing to remove milk solids. Some studies have indicated a repeated recontamination of teat cups from the cool water pail after an infected cow has been milked. It may be desirable to destroy mastitis bacteria in this rinse solution as fast as they are added from infected cows.

Fourt *et al.*[2] and Mueller and Seeley[8] have recommended using an extra head and teat cup assembly for each milking unit. This enables immersion of one teat cup assembly in germicide while the other is in use and thus provides a longer exposure to germicide.

As might be expected, the number of mastitis bacteria inoculated onto teat cups determines how complete destruction by the germicidal rinse will be. When low numbers were inoculated, destruction was almost complete, but higher numbers rendered complete destruction more difficult. Another very important factor is the physical (and possible sanitary) condition of the teat cup inflations. As shown in table 2, old, worn inflations were extremely difficult to disinfect in the mastitis sanitation pro-

cedure. This has been demonstrated repeatedly. Results indicate that a worn and cracked inflation may even approach the condition of a reservoir of mastitis bacteria along with other types.

The marked reduction in every case in numbers of mastitis streptococci on teat cups due to the germicide rinse, and the simplicity of the added step certainly justify teat cup disinfection in the milking procedure. This step together with the udder wash before milking both fit into the fast milking system and occasion hardly any delay in the milking routine. Changing the germicide solution frequently enough to maintain solution strength obviously is desirable. Results indicate about equivalent destruction of mastitis streptococci by quaternaries and hypochlorites. One advantage of quaternaries over hypochlorites for teat cup disinfection in the mastitis sanitation procedure is that a warm solution of hypochlorite may cause faster deterioration of rubber inflations due to the oxidizing effect of the hypochlorite. Quaternaries also may avoid chapping of teat surfaces coming in contact with the germicide on the disinfected teat cups.

Species of bacteria such as *M. pyogenes aureus* may show greater resistance to action of some germicides than does S. *agalactiae*[16] but the sanitation principles developed in the studies on mastitis streptococci in general should apply as well to other causative bacteria.

The question of quaternary contamination of milk from teat cup disinfection procedures is frequently brought up. Studies indicate that this step with reasonable care introduces an insignificant quantity of quaternary into the milk. Equipment such as pails, strainers, surface coolers and cans, sanitized with quaternary instead of hypochlorite may contribute detectable quantities of quaternary to the milk. Quantities of quaternary contributed by proper mastitis sanitation procedures have been below detectable levels.

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THERMAL METHODS

(continued from page 21)

for or adaptable to the measurement of holding time by thermal methods were compared with those obtained with the 3-A standard salt test. These comparative tests were run on two pasteurizers with capacities of about 3,000 and 6,000 pounds per hour, respectively. The correction factor, or difference between the holding times as measured by the salt test and a particular thermal test, varied with the different instruments when they were used on the same pasteurizer. The correction factors also varied when the same instrument was used on different pasteurizers. Correction factors found in these tests ranged from about 0.4 second to 8.0 seconds.

When the experimental, 6,000-pound-per-hour pasteurizer was operated at 75 percent of its rated capacity, there was a marked increase in the correction factor over that found for the normal capacity. Increasing the capacity of the pasteurizer 25 percent above normal caused little change in the correction factor.

The holding time, and hence the correction factor, varied with the pasteurization temperature when using a thermal timer with a preset response point. With a pasteurizer operated at 6,200 pounds of water per hour, the correction factor went from 5.78 seconds at 159° F to 2.62 seconds at 162°F when the response point for both bulbs was set at 162.4°F.

THE FOOD EQUIPMENT STANDARDS PROGRAM OF THE NATIONAL SANITATION FOUNDATION*

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The procedures of the 3-A Standards Committee of the International Association of Milk and Food Sanitarians are being used as a guide in developing similar standards for general food service equipment. This work is being carried out through a Joint Committee on Food Equipment Standards working under the auspices of the National Sanitation Foundation. Among the organizations represented are the International Association of Milk and Food Sanitarians, United States Public Health Service and American Public Health Association. Standards for soda fountains, dishwashing machines and general food service equipment have already been developed in cooperation with the affected industries. These standards, soon to be published by the Foundation, should be of material assistance to food sanitarians and food industry representatives.

A STUDY of the sanitation programs of the various political subdivisions of the United States would reveal some interesting contrasts. Sanitarians from Florida to Oregon would give practically identical answers to the question, "What are the right time and temperature conditions for pasteurization of market milk?" There would be found a high degree of conformity to required pasteurization procedures. The milk processing buildings, room, and facilities would generally be of such high sanitary standards as to encourage invitations for regular inspection by groups of school children and clubwomen.

In some other fields of sanitation, our study would show a marked contrast. There would be a surprising lack of uniformity in the food sanitarian's answers to the question "What time and temperature conditions are required for effective machine washing and sanitizing of eating utensils?" Checks of actual operating conditions would commonly reveal neglect of this important health measure. Some dishwashing machines and hot water systems would be designed and installed so as to preclude their being operated in compliance with any acceptable standards. While we would find many sanitary restaurant kitchens and dishwashing rooms, there would be ample justification for the "private" signs so commonly found on doors leading to restaurant kitchens.

STANDARDS ARE ESSENTIAL

Improvement will depend upon several factors including:

1. National agreement on sanitary standards for equipment shipped throughout the country.

2. Uniform standards for better design, construction, and arrangement of food establishments.

3. Agreement on operation and maintenance requirements so food handlers, who as a class are migratory, need not learn new standards for each state and community.

The Joint Committee on Food Equipment Standards of the National Sanitation Foundation is providing means for meeting these requisites. Some food establishment equipment is already being built in accordance with Foundation standards. Printed copies of standards for food equipment sanitation standards will soon be available to guide industry and sanitarians.

*Presented at 38th Annual Meeting, International Association of Milk and Food Sanitarians, Inc., Glenwod Springs, Colo., Sept. 26-29, 1951.

Joint Committee on Food Equipment Standards, National Sanitarian Foundation.

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INTERNATIONAL ASSOCIATION PROVIDED LEADERSHIP

The INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS can point with pride to its leadership in the development of uniform standards for the sanitary design of equipment. The 3A Committee demonstrated how public officials and industry can work together to achieve a common goal.

Drawing on those successful experiences, Past-President Walter Tiedeman, early in 1948, appointed a Committee on Food-Handling Equipment. That committee, under the co-chairmanship of C. W. Weber and C. A. Abele, recognized the desirability of working with other organizations and equipment designers, manufacturers, installers, and users. In its first report the committee said, "We are fortunate . . . an organization . . . has already made great strides toward the goal of sanitary design of food-handling equipment . . . We would like to extend to the National Sanitation Foundation an invitation to collaborate in this work and to offer our full cooperation".[1]

At a meeting in Ann Arbor sponsored by the National Sanitation Foundation in June, 1949, A. W. Fuchs, President of the Association, presented the committee's plan to representatives of six national sanitation organizations. With encouragement from Walter Snyder, these organizations developed procedures for organizing a Joint Committee on Food Equipment Standards.

It was recommended that the Foundation proceed to invite industry groups to form "task committees" to formulate preliminary drafts of sanitary standards for review by the Joint Committee.

The Committee recognized the importance of wide industry and official acceptance of Foundation standards; and that acceptance depends entirely on the standards being based on sound, basic research or on the best considered judgement of the authorities. It was agreed that it is most important for the entire membership of the participating organizations to understand and support the procedures of the committee.

The Joint Committee drafted and the Council of Consultants of the Foundation subsequently approved a detailed statement of procedures to be followed.[2] One recommendation provided for appointment of a secretary by the National Sanitation Foundation and election of a Chairman, who is a delegate-at large, to be selected from the 30 members of the Foundation's Council of Consultants. Mr. Walter Tiedeman is Secretary of the Committee. As a full-time member of the Foundation's staff, and with travel funds and freedom of action not usually available to a public employee, he has greatly expedited the work of the committee and of the industry task committees. He reviews manufacturing problems at plants where equipment is designed and made, arranges for research to answer particular questions and will follow up to determine when a Seal of Approval is merited.

The rules authorize individuals or organizations to recommend projects. Priorities are to be established by the Foundation in accordance with procedures approved by the Council of Consultants.

The Committee's operational procedures provide ample opportunity for especially interested officials of industry and health agencies to study and comment on preliminary drafts. The representatives of the participating agencies have all shown a sincere desire to obtain for guidance from the members of their organizations. They function in much the same manner as elected public officials. They will closely follow the general principles endorsed by their members but on the other hand, just as it is impractical for all legislative matters to be determined by a vote of the people, committee members cannot submit all details to the entire membership of their organizations. They will submit each preliminary draft to all members of their organization's committees and will encourage consultation with especially interested and qualified members and individuals.

After the final draft is approved by the Joint Committee it is submitted by the Foundation's Executive Director to the Council of Consultants for review and approval. The Foundation will publish approved standards suitably illus-

JOINT COMMITTEE ESTABLISHES PROCEDURES

In the fall of 1950, the Joint Committee met at the Foundation's headquarters. Its members and their affiliations are:

C. W. Clark ..... National Sanitation Foundation
A. H. Fletcher ..... Conference of State Sanitary Engineers
A. W. Fuchs ..... U. S. Public Health Service
M. A. Hilbert ..... Conferences of Municipal Pub. Health Engineers
W. D. Tiedman ..... Engineering Section, American Pub. Health Assn.
C. W. Weber ..... International Assn. of Milk and Food Sanitarians

Representing industry were:

G. S. Blackeslee ..... Dishwashing Machine Manufacturers
A. W. Forbriger ..... Food Service Equipment Industry
C. J. Palmer ..... Soda Fountain Manufacturers
Stanley Knight ..... Soda Fountain Manufacturers

Dr. Walter Mallmann was a consultant in formulating dishwashing machine standards. The author attended as a consultant on soda fountains. Mrs. Walter Snyder represented the Foundation.

trated, to serve as guides for industry and control officials. The standards will form the basis for awarding the Foundation's Seal of Approval.

"SEAL OF APPROVAL" PROGRAM ADOPTED

Milk sanitarians know that equipment which bears the 3A approval is designed and built so it can be maintained in a sanitary condition. The National Sanitation Foundation "Seal of Approval" will furnish similar assurances to food sanitarians. Careful consideration is being given to developing practical procedures for awarding the seal for use on approved equipment.

Mr. L. J. Peterson, Administrative Director of the Idaho State Department of Public Health, is chairman of a committee appointed by the Foundation's Council of Consultants to study this problem. Other members of the committee are Herbert Dunsmore, Clarence Klassen, Jerome Trichter, and the author. Rules were developed by the committee and have been approved by the Foundation. These will soon be used as the basis for checking specific equipment against the standards recommended by the "Joint Committee". Safeguards are provided to make sure that equipment on which the Seal of Approval may be displayed complies with all practical, reasonable sanitation standards

DEVELOPMENT OF STANDARDS A LONG PROCESS

The development of sanitary standards involves a vast amount of labor and deliberation. Standards in some fields must be based on extensive research. For instance, the basis for standards for dishwashing machines is the extensive Foundation-sponsored work of Dr. Mallmann and his co-workers published in the two well-known bulletins on machine dishwashing. Their five years of work involved much original research work which is now familiar to most sanitarians. It included development of an artificial dish soil and a soil meter. Wash water volumes, velocities, pressures, temperatures, detergent strength and spray patterns were all found to be inter-related variables. Time and temperature requirements were established from research data. These data are now being incorporated into standards that must be practical for machine designers while producing utensils satisfactory to sanitarians and restaurant operators.

The industry task committees perform a major role in the program. They, in cooperation with the Joint Committee's Secretary, prepare the detailed, preliminary standards.

Paralleling the experiences of the 3-A Committee, industry representatives are as genuinely interested in our objectives as they are in their own manufacturing and merchandising problems. The spirit of cooperation exhibited at the Foundation's First National Sanitation Clinic is evident at meetings with each of the task committees.

Each of the participating organizations has made valuable contributions. Mr. Fuchs has provided the benefit of comments from each of the United States Public Health Service District Offices. The National Association of Sanitarians committee and its subcommittees have devoted many hours to study and constructive criticism of the preliminary drafts. Reports of this Association's Committee Chairman Weber modestly tell of its work and contributions. Mr. Morton Hilbert has carried on extensive correspondence regarding standards with many members of the Conference of Municipal Public Health Engineers in addition to his work with their food equipment committee. Mr. Alfred Fletcher has similarly arranged to bring to committee meetings the considered opinion of leaders in this field among the State Sanitary Engineers.

This spirit of all working together toward common objectives is producing results and agreement at a surprisingly rapid pace. This, in spite of some weighty decisions. For instance, the $64 question throughout the consideration of soda fountains concerned space under units. After hours of deliberation, tentative agreement was reached. However, when Joint Committee members and industry task committee representatives met with their groups, further questions arose. The entire committee was brought to Ann Arbor for another full day of deliberation on this one point. Temporary standards were then adopted. It was proposed that, within 5 years, all ice cream containers be made shorter. The reduced container height would permit fountain manufacturers to provide adequate clear space underneath for cleaning and inspection.

Meetings subsequently held with ice cream manufacturers brought out the fact that ice cream manufacturers are really the customers of the soda fountain manufacturers. The ice cream industry spokesmen felt they must continue to make ice cream containers that fit existing units, that existing metal containers could not be discarded. "The customer is always right", so new solutions were sought and agreed to. The final standards will accomplish our sanitation objectives without upsetting the industry.

"LETS PULL TOGETHER" SPIRIT NEEDED

There can be no compromise on matters which directly affect the public health. On the other hand, compromise is sometimes essential on items with which foods do not come in direct contact but which may affect ease of general cleaning or inspection. Sympathetic understanding on the part of all sanitarians is requisite to wide acceptance of standards by officials, by industry, and by the public. The standards and the Seal of Approv-

al will gain acceptance only in accordance with how they are supported and promoted by sanitarians and regulatory officials. New standards usually necessitate the spending of large sums to redesign machines, to change dies and for more durable materials. To stay in business the equipment fabricator must meet competition. This means that new standards must be accepted and demanded by enough users to permit cost reductions through mass production.

The importance of this point may be illustrated by the case of a large organization which has many soda fountain and luncheonette installations in most states. They bought some new soda fountains which were equipped with syrup pumps, built in accordance with the Foundation's sanitary standards. When the new syrup pumps were taken apart for cleaning, some parts were lost. The company's solution is further evidence of the need for national recognition and support of standards. To avoid the expense of replacing lost parts, they decided that new fountain installations would have the cleanable pumps only where locally required. It is reported that of the hundreds of cities and counties where they operate, only four seemed officially interested in this subject. All but these four localities are being supplied with the old impossible-to-clean pumps.

Uniform acceptance of standards is an economic necessity for manufacturers. The costs of producing cleanable syrup pumps will be excessive if the sanitation standards are of interest to only a few localities.

In the last analysis, the consuming public pays the bills of the manufacturer, installer, and the user. Uniform national standards will mean better quality equipment at a reasonable unit cost. Only through uniform standards can we hope to really improve our national food-handling programs. Joint action through the National Sanitation Foundation can elevate our entire national sanitation program. Let's apply sympathetic understanding in considering cases where compromise is necessary or where we do not fully agree with the group judgment embodied in the standards. Official approval by this and other organizations will add materially to the acceptance of the standards by official agencies and by industry. In the words of Mr. Carl J. Palmer in his article, "Association Cooperation for Better Sanitation",[3] "Sanitarians are now carrying the ball. What they do with it will decide the game."

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CLEAN HANDS*

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Management has the responsibility of providing ample washing facilities so that the employee can keep himself clean, besides arranging for clean uniforms, aprons, hair nets, caps, boots, and other wearing apparel. This is still not enough, as it should also educate the employees through the supervisors or by means of posters or circulars on why it is important that the product be clean. A punch line like, "Would you like to eat the food you are packing, and would you recommend it to your friends?" could be quite effective.

Hand-washing facilities are oftentimes very much over crowded so that some of the people are unable to get their hands washed before it is time to go to work on the line. There are a number of good soaps and sanitizing type soaps that can be used. A lot of companies have found it advantageous to use sanitizing soaps containing agents such as hexachlorophene, as these have a residual bactericidal effect, and they also reduce the number of hand infections. The people can clean their hands with soap and water and rinse under continuous or foot-operated water sprays after which they can wipe their hands with disposable towels or ordinary sanitary toweling. Some plants do not always provide warm water for the washing of hands, and people just don't like cold water for hand-washing. If the employee with clean hands has to open a door with a dirty knob or grabs a dirty hand rail while leaving the washroom, then very little has been accomplished by washing the hands in the first place.

Hand-rinsing and knife-rinsing facilities are desirable on the eviscerating line. Here again the water should be lukewarm and the water sprays or jets should be conveniently located. Some plants have water spraying continuously from perforated pipes while others provide one water spray for each pair of operators.

Hair nets or caps are, of course, a must, and hair can get into the product even though the operators wear hair nets or caps. A lady can comb her hair and then wipe the comb on her uniform. The hair can stick on the uniform and fall off or rub off into the product at a later time.

(continued on page 35)

*Presented at Sanitation School, Institute of American Poultry Industries, held April 19 and 20, Chicago.

Supreme Court Invalidates Factory Inspection of Food Act

Enforceability of the factory inspection provisions of the Federal Food, Drug, and Cosmetic Act was nullified by the Supreme Court in a case decided December 8, the Food and Drug Administration of the Federal Security Agency.

Factory inspection is now on a voluntary basis. There is no legal compulsion on a plant owner to admite inspectors if he does not want to.

The 8-1 decision written by Justice Douglas held that the sections of the statute authorizing inspection "after first making request" and providing criminal penalties for refusing to give consent were too contradictory and uncertain to stand as criminal law. The Court said that the statute as written was not "fair warning to the factory manager that if he fails to give consent, he is a criminal."

The decision was handed down in the case of U. S. v. Ira D. Cardiff. After repeated refusals to admit the FDA inspectors to his apple dehydrating plant Dr. Cardiff was prosecuted for refusing entry and fined $300 by the U. S. District Court at Spokane, Washington. He appealed, and the verdict was set aside by the U. S. Court of Appeals for the Ninth Circuit. The Government then took the case before the Supreme Court, which decided in favor of Dr. Cardiff.

When queried about the effect of the decision, C. W. Crawford, Commissioner of Food and Drugs, issued the following statement.

"The Supreme Court decision knocks out the enforceability of the factory inspection provisions of the Federal Food, Drug and Cosmetic Act, and by so doing it also makes impossible enforcement of other vital sections of the Act which require evidence obtained by factory inspections.

"All the provisions of the law to protect the consumer's health and pocketbook are most efficiently enforced through factory inspection simply because adulterations can best be detected at their source by going into the plant and seeing what is being done. The provision which forbids shipment of foods, drugs and cosmetics which have been produced under insanitary conditions can hardly be enforced at all except through factory inspection. In those instances where soluble filth gets into the product itself, laboratory analyses cannot be relied upon to detect it, and here again factory inspection evidence is essential. In the field of drugs, there is no other way to check the control methods used by manufacturers to insure purity, potency and correct labels on products which often mean life or death to the patient.

"We must ask Congress to clarify the wording of the law and to restore to the American public the protection which we are sure the Congress intended to provide in the Act of 1938.

"In the meantime we are sure that the great majority of manufacturers and distributors of foods, drugs and cosmetics will want our inspectors to keep on checking their plants just as they have in the past. Many assured us that in the event we lost the case in the Supreme Court they would support remedial legislation. However, those manufacturers who have something to hide, whether filth or other reprehensible conditions, will no doubt tell our men to keep out, just as they did in the old days under the Act of 1906. In such cases we will simply do our best through sampling and laboratory analyses of products to get our evidence, inadequate as it may be in some cases.

"The majority of industry will protect the interests of consumers by continuing to put out clean, wholesome, truthfully labeled products, but protection from the activities of the shady fringe will be substantially reduced."

On December 19 Commissioner Crawford announced that the Food and Drug Administration had decided on the form of amendment of the Federal Food, Drug, and Cosmetic Act which it will recommend to restore enforceability of factory inspection. He said that in the hope of speedy action he would ask for "a simple change in wording to replace the ambiguous language upon which the Court invalidated the section." The change would require a Food and Drug inspector to give written notice to the management of his intention to inspect the plant when he enters the premises.

The language responsible for the Supreme Court's decision authorized the inspector to enter and inspect the premises "after first making request and obtaining permission" . . . and then punished refusal of permission by fine and imprisonment. The proposed change would strike out the quoted wording and authorize the inspector to enter and inspect "after first giving written notice." The penalties for refusal would remain unchanged, but the revision would make it clear that the right to inspect is not contingent on obtaining permission of the person in charge.

"Up to the time of its invalidation by the Supreme Court the factory inspection section had proved workable and highly useful. I am not anxious to consider any change except to restore its validity. Other changes would provoke controversies and delay enactment," Mr. Crawford said.

On the assumption that the majority of food, drug, and cosmetic manufacturers will grant permission to inspect their premises and records, FDA instructed its field organization to continue their project operations as in the past. Inspectors were instructed to report all facts on refusals to permit inspection, with proposals as to how the violations which may exist can be investigated.

Assurances have been received from several trade associations that they would support the proposed form of amendment. These groups include the American Drug Mfg. Assn., the American Pharmaceutical Mfg. Assn., and the Toilet Goods Assn., Previously the Grocery Manufacturers of America and several other food industry organizations had issued statements that they would support legislation to restore the factory inspection authority.

MILK and FOOD SANITATION

AN APPROACH TO FIELD TRAINING

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The field training program of the Department of Public Health, Indiana University School of Medicine, provides the student with ten weeks of actual inspection work on an individual basis with qualified sanitarians. The field training is given in both food, drug, and dairy manufacturing industries and in retail food and fluid milk programs. Each student works with a number of sanitarians to obtain broader training in methods and techniques of making an inspection.

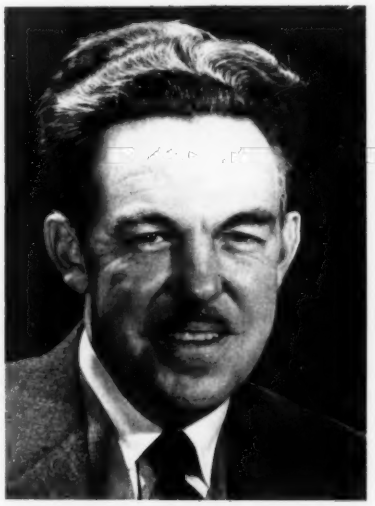
A GREAT DEAL of time and effort has been expended by educators, members of the various Federal and state health agencies and others to devise a suitable and effective field training program for in-service training and for undergraduate students in sanitary science. The report of the First Nation-wide Working Conference on Sanitation Field Training, held in Chapel Hill, North Carolina, in April, 1950, (see *A.P.H.A. Year Book* 1950-51, **41**, 5, 99-112, (May) 1951, for full report) is a valuable guide to institutions offering an under graduate degree in public health in setting up a field training program as part of the curriculum. Several of the topics discussed in this report (Objectives of Field Training, Types of Field Training, and Principles and Practices of Field Training) provide much background on which to base an effective field training program. The remaining topics are equally instructive but have less to do with problems of curricula. It should be noted that the above report is concerned primarily with in-service training of employees of health units rather than undergraduate training of students of public health. Several states are providing in-service training for public health workers and Field Training Courses for Public Health Workers are provided by the United States Public Health Service. The Report of Working Conference on Undergraduate Education in Sanitary Science, held at Battle Creek, Michigan, in April, 1951, provides other guides to a solution of many problems. Since in-service training and undergraduate training have the same objectives, material from both sources may be utilized in determining subject material, type of field training, and effective means of instruction for field training courses in an undergraduate curriculum.

The following is a report of a field training program used in Indiana for undergraduate students.

CLASSROOM WORK

The Department of Public Health of the Indiana University School of Medicine offers courses which lead to a Bachelor of Science Degree in Public Health with two options provided: A—Sanitarians, B—Health Education. This report covers the field training program in the Sanitarians option.

Although the curriculum covers the broad field of sanitation, during the senior year of the Sanitarians option the emphasis is placed to a great extent on food, drug, and dairy regulatory programs — both in the retail and the manufacturing fields. Division directors and other professional personnel of the Indiana State Board of Health who have extensive knowledge of these industries are utilized as instructors or lecturers for these courses and arrange and conduct the field trips. During the first semester, a three-hour course in Food and Milk Distribution and Production and a two-hour course in Restaurant and Milk Sanitation are given. Many industries are discussed in detail in these courses. This includes such subject matter as the sources of raw materials, inspection, of raw



Frank E. Fisher graduated from Purdue University with a B.S.E.E. in 1930. He has been employed by the Indiana State Board of Health since 1937 with the exception of three and one half years military leave during World War II when he served as a Captain in the Field Artillery in the European Theater. He is Chief of the Frozen Food Section, Division of Food and Drugs, Indiana State Board of Health. He is a Lecturer in the Department of Public Health, Indiana University School of Medicine, and is in charge of the field training program for undergraduate students in Sanitary Science. He has published several papers in the field of sanitation, particularly dealing with locker plant and slaughterhouse sanitation.

materials and ingredients, ingredient, and raw material cleaning equipment, preparation methods and equipment, packaging methods and machinery, processing and sterilization of the product, storage of the finished product, and labeling of the finished product. All of the major food, drug, and dairy manufacturing industries are covered in this detail. The restaurant and fluid milk programs are discussed in similar detail.

These courses are supplemented by field trips which are co-ordinated with the subject matter of the courses. When the classroom discussion is concerned with the slaughter of meat animals and the manufacture of meat products, a field trip is arranged at a meat packing plant so that the student may become familiar with the various types of equipment and the processes used in this industry. Therefore, when the instructor mentions a "silent cutter", the student has at least seen one and has had an opportunity to observe the equipment in operation.

FIELD TRAINING

During the second semester of the senior year, a period of ten weeks is provided exclusively for field training of the students. Prior to this school year of 1951-1952, this field training was provided by administrative personnel of the State Board of Health. When classes were small—four or five senior students—this method was satisfactory, but when classes became larger—nine or ten seniors—it became apparent that it would be necessary to make other arrangements for field training.

The Indiana State Board of Health has five branch offices located throughout the state to provide service to the public, close to home. Each branch office is staffed with food sanitarians, dairy sanitarians sanitary engineers, nurses, health educators, and others. The sanitarians in the branch offices inspect all types of food and dairy manufacturing establishments in their assigned areas, make necessary special investigations, investigate food poisoning outbreaks, exercise supervision over local inspectors in cities where food or milk ordinances are in effect, and perform all duties usual to sanitarians on the state level. Personnel of the Indiana State Board of Health are employed and work under a merit system, and are well-qualified for the duties they perform. Therefore, a number of qualified field sanitarians in the the food and dairy fields are axailable in the branch offices to provide field training for the students.

During the 1951-1952 school year, two senior students in the Sanitarians option were assigned to each branch office for field training. An individual schedule was arranged for each student so that he would receive actual inspection experience in a number of food and dairy manufacturing industries. The industries inspected included cold storage locker plants, slaughterhouses, poultry-dressing establishments, bakeries, bottling plants, food warehouses, drug manufacturers and repackagers, cheese plants, ice cream plants, evaporated milk plants, condenseries, dried-milk plants, and butter manufacturers. (See table 1 as an example of a student's schedule.) While no special emphasis was placed on drug problems, each student made several inspections of drug plants with the State Pharmaceutical Inspector. No specific time was allotted in the schedule for such subjects as insect or rodent control, private water supplies, sewage disposal systems, or garbage and waste disposal since it was felt that these subjects would be adequately covered in the routine inspection work.

INSPECTIONS

From three to five inspections were made in each industry. The first inspection in each industry was made by the sanitarian while the student observed inspection methods and techniques, and attended the sanitarian's interview with management to discuss conditions which were in violation of the Public Health Code and to make recommendations for their correction.

The intermediate inspections were joint inspections, with the sanitarian taking the lead but encouraging the student to make observations and participate in the interviews. All of these visits were routine, unannounced inspections as normally made in the course of the sanitarian's regular work.

The last inspection in each industry was prearranged in that management was contacted prior to the inspection, an explanation was made of the field training program, and permission obtained for the student to make an inspection of the plant. This final inspection in each industry was made by the student with no assistance from the sanitarian. The sanitarian accompanied the student to observe conditions in the plant, and to observe the student's ability to conduct the inspection and the interview with management.

All inspections were comprehensive in scope and included such items as,

1. The inspection of raw materials and ingredients for contamination or adulteration;

2. The inspection of equipment and machinery for cleanliness;

3. The observation of manufacturing processes for methods, controls, adulterations, or contamination;

4. The inspection of sanitary conditions in and around the plant;

5. The inspection of storage and handling of raw materials, and storage of the finished product;

6. The inspection of labeling for possible misbranding;

7. The inspection of equipment and facilities for cleaning;

8. The inspection of toilet and handwashing facilities for employees;

9. The inspection of private water supply and sewage disposal facilities where provided.

Before the actual inspection was begun, management was interviewed to obtain the history of the business, the products manufactured by the firm, and the names of the responsible officials of the firm. At the conclusion of the inspection, management was again interviewed to discuss objectionable or insanitary conditions and to make recommendations to correct these conditions.

REPORT WRITING AND GRADING

The student was required to write a complete report of the final inspection in each industry. The report included such items as the history of the business, raw materials and ingredients, equipment, manufacturing processes, sanitary conditions in and around the plant, violations noted or suspected, recommendations made to the manufacturer, and attitude of the manufacturer. In addition, when necessary, exhibits of labels, cartons, and circulars were collected to accompany the report. Where evidence was found of insect or rodent infestation or inadequate cleaning of equipment, exhibits were obtained to accompany the report. When indicated by conditions observed during the inspection, samples were taken of raw materials or finished products for laboratory analysis.

The student received two grades for each industry inspected—one grade being based on his attitude, aptitude, and method of conducting the inspection and the conference with management; the second being based on the accuracy, completeness, and logical arrangement of the inspection report. The grading was done by the sanitarian who accompanied the student on the inspection. All inspection reports were reviewed by a faculty member to eliminate, as far as possible, variations in grading by different sanitarians. After a report was graded, it was discussed with the student and an explanation was given of the mistakes and shortcomings of the report so that the student could improve his report writing ability.

The schedule was arranged so that during the field training in food and dairy manufacturing industries, the student worked with from three to five sanitarians. This gave him an opportunity to observe different methods of approach and individual inspection techniques, thus broadening the base of his training. By this method, the student is graded by several different individuals, thus minimizing the effects of any possible personality clashes.

TRAINING IN LOCAL UNITS

The field training in retail food and fluid milk inspection was provided in city or city-county health units which are enforcing Grade A restaurant and Grade A milk ordinances. Students were assigned for a period of three weeks in these local units, and worked one week on the restaurant program and the two remaining weeks on the fluid milk program. The student received individual attention from the local sanitarian, and, as far as possible, followed the regular routine of the local man. Training in the retail food field consisted of inspections of restaurants, groceries, meat markets, and other retail food outlets. Again, the first inspections were made by the sanitarian, followed by joint inspections, and culminating in inspections made by the student alone. Approximately one half day was spent in explaining and demonstrating to the student the records normally kept in local health departments in this phase of the work.

In the fluid milk field, the two-week period was evenly divided between farm inspections and plant inspections. It is realized that this division of time is not truly representative of the work of a local sanitarian enforcing a Grade A milk ordinance, but due to the large variety of equipment used in dairies, it was felt that we were justified in this time breakdown to give the student a better opportunity to become familiar with the equipment and processes used in dairies. Time was also allowed to teach the student how the necessary records were kept.

Each student was graded on both retail food and fluid milk in a manner similar to the method outlined for food and dairy manufacturing industries. Again, each student worked with from three to six different sanitarians during this phase of the training. Therefore, during the field training program, each student worked with, observed, and was graded by at least six different sanitarians, thus giving him an opportunity to observe methods and techniques as practiced by several different individuals and enabling him to evaluate in his own mind the relative effectiveness of the different methods.

ELECTIVE DAYS

Although the individual schedule for each student was detailed and included a definite number of inspections to be made in each industry, some flexibility was provided by including two elective days. It is common knowledge that emergencies arise in the work of a sanitarian which disrupt plans and tight schedules. These elective days were provided in the schedule so that the student would find it possible to work with and assist the sanitarian in necessary special investigations. During this school year, some of the students participated in such activities as, supervision of the salvage of foods involved in a train wreck; supervision of segregation and salvage of foods, drugs, and cosmetics involved in a fire in a drugstore; investigation of an outbreak of trichinosis; shadowing a meat peddler suspected of selling horsemeat; attending a meeting of a city council when a proposed ordinance for the inspection and regulation of retail food establishments was introduced; investigation of a produce dealer packaging "green wrap" tomatoes in pink-tinted cellophane to enhance the

appearance of the tomatoes; conferring with a local prosecuting attorrney concerning a libel and seizure action again a lot of violative tomato products; pre-race inspection of itinerant food stands at the Indianapolis Motor Speedway; accompanying an inspector of the Federal Food and Drug Administration to investigate and obtain records of an interstate shipment of a food product, thus gaining an insight into the methods and procedures involved in the work of this agency; and supervising the denaturing of a large quantity of violative corn meal and flour, and converting the merchandise to animal feed. In those cases where both elective days were not used on special investigations, the student made his own decisions as to the industry or activity he wished to visit.

SEMINAR

At the end of the field training program, the students were brought back for a one-day classroom session in order to answer all questions not clear in their minds, to discuss the students' observations of the methods and inspection techniques used by different sanitarians, and to discuss with the students their opinions concerning the weak points as well as the strong points of the program. As a result of this conference, several changes are being made in the program for the next school year.

This year's class felt that since fifty percent of their grade on the field training course was determined by the inspection reports which they wrote, additional training in report writing should be given during the period of academic training. As a result, the fundamentals and technique of report writing will be integrated into the classroom work next year. The 1952 class was of the opinion that definite provision should be made to include insect and rodent control, private water supply and sewage disposal systems, and garbage and waste disposal in the field training program for subsequent classes. They also felt that a full week of farm inspections during the training in the fluid milk program became too repetitious and that too much time had been allotted to this phase. Plans are being made to shorten the time allotted to farm inspections and to spend this time on environmental sanitation.

While no claim is made that the field training program was perfect and with the realization that improvements can be made, it is felt that, on the whole, a balanced, well-rounded training has been given. The principal objection to the present program lies in the fact that the sanitarians providing instruction are not trained as instructors. It is realized that the ability to do a job is not always consistent with the ability to teach another how to do the job. It has been possible to overcome this objection partly by arranging for each student to work with from six to ten different sanitarians during his field training program. It is realized that the student will require additional on-the-job training after graduation, but it is felt that he has been given the basic knowledge on which to build, regardless of what field of sanitation or regulatory activity he enters after graduation. He has a basic knowledge of the equipment, machinery, and processing methods used in a broad cross section of the food, drug, and dairy manufacturing industries, and a knowledge of the problems encountered and methods used in local departments in enforcing retail food and fluid milk sanitation programs. It is realized that a field training center under the supervision of a full-time training officer has much merit and would help to overcome some objections encountered in the present plan, but until such time as a training center is established, the present field training program with slight modifications will be continued unless and until a better method is devised.

SUMMARY

1. The field training program of the Department of Public Health, Indiana University School of Medicine was established after careful consideration was given to comparable training courses in other institution and in-service training courses offered by Federal and state agencies with certain modifications to fit the program to the academic training in the curriculum.

2. Field trips are arranged to coincide with classroom discussions.

3. Ten weeks of field training is given individually to each student by qualified sanitarians.

4. Training is given in at least fourteen different food, drug, or dairy manufacturing industries with a minimum of thirty-five inspections in these fields. Each student worked with from three to five sanitarians in these fields.

5. Three weeks of training in retail food and fluid milk inspection is given in city or city-county health units enforcing Grade A ordinances with one week alloted to retail food markets and two weeks to fluid milk work. Each student worked with from three to six sanitarians in these fields.

6. Students are enabled to accompany sanitarians on special investigations.

7. Constructive criticism offered by students is being utilized to strengthen subsequent field training programs.

8. A balanced; well-rounded field training program is being offered.

9. Each student works with at least six and as many as ten different sanitarians, overcoming the problem of variations in the ability of the sanitarians to teach. Each student is graded by all the sanitarians he worked with, thus overcoming variations in strictness of grading by different sanitarians.

10. It is realized that the present program has certain shortcomings both in subject matter and in instruction ability of the sanitarians providing the field training.

11. Graduates are capable of assuming responsibility of inspection work under proper supervision.

TABLE 1 — FIELD TRAINING PROGRAM

Student — Hoyt Wilson Favor

March 24 Manufactured Milk (Cheese)
25 Manufactured Milk (Cheese)
26 Manufactured Milk (Butter)
27 Manufactured Milk (Ice Cream)
28 Manufactured Milk (Ice Cream)

March 31 Drugs
April 1 Drugs
2 Drugs
3 Manufactured Milk (Powdered Milk)
4 Manufactured Milk (Consensed Milk)

April 7 Manufactured Milk (Counter Freezers)
8 Bottling Plant
9 Bottling Plant
10 Spring Vacation
11 Spring Vacation

April 14 Spring Vacation
15 Spring Vacation
16 Spring Vacation
17 Locker Plant
18 Locker Plant

April 21 Locker Plant
22 Bakery
23 Bakery
24 Bakery
25 Elective

Branch Office — Indianapolis

April 28 (Indianapolis) Fluid Milk (Farms)
29 (Indianapolis) Fluid Milk (Farms)
30 (Indianapolis) Fluid Milk (Farms)
May 1 (Indianapolis) Fluid Milk (Farms)
2 (Indianapolis) Fluid Milk (Farms)

May 5 (Indianapolis) Fluid Milk (Plants)
6 (Indianapolis) Fluid Milk (Plants)
7 (Indianapolis) Fluid Milk (Plants)
8 (Indianapolis) Fluid Milk (Plants)
9 (Indianapolis) Fluid Milk (Plants)

May 12 Slaughterhouse
13 Slaughterhouse
14 Slaughterhouse
15 Food Warehouse
16 Retail Foods

May 19 (Muncie) City (Restaurant, groceries and meat markets)
20 (Muncie) City same
21 (Muncie) City same
22 (Muncie) City same
23 (Muncie) City same

May 26 Retail Foods
27 Poultry
28 Poultry
29 Elective
30 Legal Holiday

CLEAN HANDS

(continued from page 29)

Uniforms should not be allowed to become too soiled before being changed. They get more contaminated on some jobs than on others, so arrangements can be worked out so that the dirtier uniforms can be changed more often. Rubber or plastic aprons which can be easily cleaned off can oftentimes be worn over a uniform in a messy operation, and they can save considerably on the laundry bill.

People with cuts, infections, or bandages on their hands should preferably be shifted to a non-food-handling job where their hands do not actually come in contact with the food itself. If this is not possible, then rubber gloves should be worn over such hands, although sometimes in warm weather the operators remove their gloves, as they get quite uncomfortable, and this is, of course, not good.

Many plants do not pay enough attention to the selection of personnel for food handling. You run into so-called unsavory characters who do not have any good idea of cleanliness, such as the type that blows their nose without using a handkerchief. Such people are better off on a non-food-handling job, as they not only contaminate the food themselves by handling it, but they are also bad on the morale of the rest of the help.

Dirt under fingernails can be a source of contamination. Some plants provide manicuring services while others get good results by furnishing nail-cleaning equipment such as orange sticks.

Employees with severe colds or chronic coughs should preferably be shifted to non-food-handling jobs although some supervisors do not like to do this, as this requires additional training of the replacement personnel.

Ordinary handkerchiefs are usually quite unsanitary, and you can contaminate foods with your hands after using a handkerchief. Disposal kleenex-type tissues from dispensers would be more ideal, although they are a bit expensive.

Clean birds keep better and longer than unclean birds, and this is particularly true when the poultry is mishandled after it leaves your plant. This is covered very nicely by the Army when they state that if the poultry they buy has two or three strikes against it, then it will stand very few strikes if it is abused after they get it. If clean birds are delivered to them, the birds will stand a few strikes if they are mishandled before they get bad.

CHEMICALS IN FOOD*

ROY C. NEWTON

Vice-president of Swift & Co., Chicago, Illinois

Public misunderstanding regarding chemicals in food must be corrected by the food industry itself, Dr. R. C. Newton, vice president of Swift & Company in charge of research, said May 27, 1952.

Speaking at the 43rd annual convention of the Flavoring Extract Manufacturers' Association at Chicago's Edgewater Beach Hotel, Dr. Newton said chemicals play an important role in future progress in the food industry. However, he advocated thorough testing of new substances before they are used.

Pointing out that actually all foods are chemical, Dr. Newton said for centuries man has used many chemicals in processing his foods.

"These chemicals have stood the test of time and are universally accepted as wholesome", he said. "There is no logical reason, therefore, why the public sometimes should give the word 'chemical' a sinister connotation."

"Safety is the first and by all odds the most important consideration with respect to human food. The food industry has always subscribed to the principle of safety first and by and large is favorable to a compulsory program for pre-testing of all new chemical substances in food. Our industry must make its position clear on this point.

"It is time the various segments of the food industry announce in unequivocal terms the high standard of ethics which has in the past and will in the future be its guide.

THE SUBJECT OF CHEMICALS in Foods has attracted much attention during the past four years. While this public attention is new, the problem itself is old to us in the food industry.

The food industry has, in fact, lived with the question for many years, but the rate of change in the chemical processing of food has been so gradual that it has attracted little attention until recently.

*Address delivered at the 43rd Annual Convention of the Flavoring Extract Manufacturers' Association of the United States at the Edgewater Beach Hotel, Chicago, May 27, 1952.

At the outset, I want to state a fact that is so self-evident that it really has no significance at all. It is that all foods are chemical substances or mixtures of chemical substances. Therefore, there should be nothing awesome about the word "chemical". For centuries man has used many chemicals in processing his foods. These have stood the test of time and are universally accepted as wholesome.

There is no logical reason, therefore, why the lay public sometimes should give the word "chemical" a sinister connotation.

The technologists in the food industry are constantly striving to accomplish one or more of the following objectives:

a. Lower cost of production. This is true whether the food be of plant or animal origin.

b. Retard the rate of deterioration from insects, bacteria, enzymes, and chemical change such as oxidation.

c. Lower the cost of processing.

d. Improve the method of distribution.

e. Improve its convenience to use.

f. Improve its palatability with respect to odor, flavor, texture, etc.

g. Retain and improve nutritive quality.

Chemicals plan an important role in all of these objectives insofar as they have been accomplished in the past, and offer great possibilities for further progress in the future. It may be said, therefore, that the food technologist has a very considerable interest in the use of chemicals in and on food products.

The chemical manufacturing industry has supplied the food producer and processor with the materials used in the past and sees clearly the opportunity for a greatly expanded business for the future. Thus arises the intense interest from a different commercial angle.

The consumer, while not always organized to be intelligently articulate, has, of course, the greatest interest in this question since it is

Dr. Roy C. Newton, vice-president of Swift & Company, in charge of research, is prominently active in many scientific organizations.

These include The American Chemical society, The American Institute of Chemical Engineers The Institute of Food Technologists, The Industrial Research Institute, The American Oil Chemists' society, Sigma Xi, and The American Association for the Advancement of Science.

Recently, he was chosen to receive the 1952 Medal of the Industrial Research Institute, Inc. Among his other awards are the Nicholas Appert Award of the Institute of Food Technologists, the Honor Scroll of the Chicago Chapter of the American Institute of Chemists, and the Agricultural Alumni Certificate of Distinction by Purdue University.

Dr. Newton has held his present executive position with Swift & Company since 1941. He joined the company in 1924 serving first as Research Chemist, Assistant Chief Chemist, and then Chief Chemist prior to assuming his present post.

A native of El Reno, Oklahoma, Dr. Newton has a Bachelors degree from Oklahoma A & M and a Ph.D. degree in Chemistry *cum laude* from the University of Chicago.

his or her physiologcal system which must tolerate, metabolize, and/or eliminate the chemical introduced along with the food. This is no new problem to the consumer since he or she has always been forced to select items of food which would be nutritive and yet harmless. This must have posed many a puzzle for ancient man as he slowly gained experience in the art of food selection. He must have made many unwise selections and suffered the consequence accordingly until there was accumulated a background of human experience to guide him. In other words, over a span of countless generations he learned to use the senses to select those food items which were good for him.

PRESENT REGULATION AND CONTROL

But what of today when the foods are processed beyond recognition of those items familiar even to his grandparents. It seems clear that these senses can no longer serve as the sole protection, so, civilized man has set up proper instruments of society to fill the gap in this necessary safeguard. In the last few years the number of new chemical substances proposed for use in foods has increased by leaps and bounds. It is essential that each of these new substances be thoroughly tested before they are introduced in the human diet. These facts must not be overlooked in the present controversy over the use of new chemicals in food.

Where should we place the responsibility for proving the new substances harmless?

Within the Federal Government there are several regulatory bureaus. I would mention two, first, the Meat Inspection Division of the Bureau of Animal Industry and, second, the Food and Drug Administration.

How much authority do these bureaus have to safeguard us as unsuspecting consumers?

The Meat Inspection Division has jurisdiction on all meat and meat food products shipped interstate, and the law authorizes them to set up regulations governing the interstate shipment of these products and to provide inspection of product and processing plants necessary to see that these regulations are complied with. These regulations have been written to include everything you can do and the kind and quality of materials you can do it with. If a proposed process is not provided for in these regulations you cannot operate the process in an inspected plant until the regulations are changed. This makes it very simple for this bureau to require proof that a new material is wholesome and edible before they will allow its use in food under M. I. D. inspection. The rigid enforcement of these regulations has given the public confidence that a piece of meat or a meat food bearing the U. S. inspected and passed legend is indeed a wholesome food product.

With the revision of the law a dozen years ago, the Food and Drug Administration was authorized to promulgate standards and definitions of food products and to recognize and set limitations for certain optional ingredients which could not be avoided or were necessary for processing, etc. Once a standard and definition has been promulgated on a food product, it is unlawful to ship interstate any of this food containing substances not included in the standard. This would seem to provide adequate authority for full protection from the addition of any untested chemical substance appearing in such food.

The Food and Drug Administration has been busy holding hearings and setting such standards, but because of the immensity of the task and the interruption of the war, there are still many more foods outside the standards than within.

In the case of unstandardized foods, the law provides authority for the Food and Drug Administration to seize any interstate shipment which contains poisonous or deleterious substances. This sounds good, but here is the catch!! As the law now stands, the Food and Drug Administration must be able to prove that a substance is injurious to the human body before it can prevent the use of that substance in an unstandardized food. This cannot always be done short of a two or three-year study. Some of the substances are not acutely poisonous but can be seriously harmful if used over a longer period of time. This, coupled with the fact that the number of chemicals proposed for use in food has increased greatly in recent years, makes it impossible for the FDA to protect the public on a practical basis under the present law.

A simple change in the law that would require the person proposing the addition of such a new substance to prove that it is harmless would relieve the situation and would provide all the safeguard to public health that is needed. The burden of proof would be shifted from the FDA to the food processor who proposed to use the new chemical substance.

The reliable food processor with qualified scientific staff has always taken every precaution to guard against hazard to the public. Such a change in the law would, therefore, require of all processors that which most of them are doing anyway.

Of course, in the case where the chemical manufacturer discovers the utility of a new chemical substance in food and proposes to sell it to the food industry, it should be the manufacturer's responsibility to present such proof to the Food and Drug Administration.

The recent activities of the Delaney Committee and the hearings on standards of identity for food

products which are being conducted by the Food and Drug Administration, have spotlighted the question of the hazards to health which may be involved in the use of various chemical substances in foods. On the other hand, there is the equally important problem of the many fine physical and nutritional improvements in foods which are made possible by the use of a variety of chemical substances which have been proved to be entirely harmless.

SUGGESTED TESTING PROCEDURE

Somehow, we must formulate a sound and complete national policy on a common sense program for pre-testing and reasonable certification of harmlessness of any new substances proposed for use in foods. New substances might include totally new chemicals, or variations in chemical structure of material normally present in certain foods. It is not at all an easy task to lay out the protocols of an adequate testing program for new chemical substances defined as above. I am personally convinced that a satisfactory program for pretesting and certification can be worked out between the chemical industry, the food industry, and the Food and Drug Administration. Our leading physiologists and pharmacologists are reasonably well agreed that an animal-feeding program can be laid out on toxicological and nutritional testing of new chemical substances that will not hinder development or research in finding and utilizing new chemical materials. Two essentials of such a program were outlined in my testimony before the Delaney Committee, made only after consultation with leaders in the field of toxicological testing. The basic consideration was that before the addition to human foods of a substance that is unnatural to foods, such a substance should be preceded by the following test program or its equivalent:

1. Acute toxicity studies.

a. Oral average lethal dose (LD_{50}) studies on several of the animals, one of which should be non-rodent.

2. Sub-acute toxicity studies.

a. On rats or other rodents for 2 to 4 months at several levels in the diet, the lowest of which should be at least ten times the level of the material proposed for use in food, and the highest should approach the maximal amount which will allow the animal to live long enough to bring about any sub-acute toxic effects, with adequate numbers of control animals.

b. On dogs or monkeys at the same levels as indicated in 2a.

3. Chronic toxicity studies.

a. On rats with adequate control groups for a period of two years at levels sufficiently greater than those proposed to be used in food to accentuate any physiological effects. The exact nature and number of such levels to be studied would be decided upon after the acute and sub-acute toxicity studies are complete. As an example of one of the levels to be studied, any chemical substance which is known to be foreign to natural food materials and which is proposed to be used in amount up to 0.05 percent probably should be studied at a level 100 times the proposed usage. When chemicals or materials foreign to natural food substances are proposed to be used in amounts between 0.05 percent and 0.2 percent, they should be tested at a level 50 times the proposed usage. When chemicals or materials foreign to natural food substances are proposed to be used in amounts above 0.2 percent, they should be tested at the highest levels which the sub-acute toxicological tests indicated will allow the animal to live long enough to bring about any chronic effects.

b. On dogs or monkeys for a period of at least 6 months, but not necessarily more than one year at low, intermediate, and high levels, the latter approaching the highest amount that was tolerated without deleterious effects (see 2b).

c. In addition, biochemical studies (urine and blood analyses), studies on blood components, reproduction through several generations, and gross and microscopic examinations on sacrificed animals from the long-term feeding tests should be carried out to a degree that would leave little doubt of the probable effect on the human organism.

4. If, after thorough testing in accordance with 1, 2, and 3, the material is proved to be non-toxic and innocuous to several animal species at unusually high levels for long periods of time and is approved for use in food, evaluation of any data on unusual effects or sensitivity in human subjects should be made during the normal course of consumption of the food products containing this material.

ERRONEOUS IDEAS

It might be well at this point to consider with you some of the erroneous impressions that have spread throughout the chemical and food industries concerning any active testing program to establish the harmlessness of new chemical substances. There have been numerous articles and editorials appearing in such sequences as to indicate that many persons do not have full realization of the delicacy of balance of chemical reaction within the human body and of the ease with which foreign substances can throw this delicate mechanism out of balance. I should like to list a number of unsound premises in the propaganda which have created considerable confusion on the subject of chemicals in foods.

The first, and perhaps the most frequent, is that of natural versus synthetic. There are those among these writers who would have us believe that the issue centers around this point. I should like to deny emphatically that this question has anything whatsoever to do with the problem of chemicals in food. Surely no one denies that many substances growing in nature are poisonous to the human being.

so that once and for all we can say that it makes no difference whether a poison is natural or synthetic, it still should be kept out of food.

The second erroneous issue is that of persecution. There is a vein of implication in many of these articles that the manufacturing chemical industry is being persecuted. Insofar as I know this is also false and should have no part of the real consideration of this important question.

The third confusing bit of philosophy is that all foods are chemical in nature. Of course, they are all chemical in nature, but that does not lead to the conclusion that all chemicals are satisfactory in foods.

Number four — you cannot prove a negative. This has been used to belittle the requirements for an adequate animal testing program before new and unusual substances are allowed in food products. Whether you can prove a negative or not is beside the point, for you can get good substantial evidence that a substance is poisonous, the extent of its poisonous quality, and the hazard presented, by its incorporation in food. You cannot always do this in a few weeks. A reasonable degree of safety requires a long-term test on experimental animals. With the rapid rate at which new substances are proposed for incorporation in foods, is this too great a price to pay for the safety of the public? I contend that it is not.

The fifth of the confusers is that even table salt is poisonous under some conditions. I think it is well established that one can cram enough table salt down his throat to kill him, but is there any doubt in the mind of any one here that table salt used by the normal individual in the manner which it has been used for thousands of years represents any hazard?

RESPONSIBILITY

You may believe me that the only true issue involved is the responsibility to see that the food product reaches the human consumer in a condition that will provide nourishment and, at the same time, present no hazard from its consumption. The fulfillment of this responsibility requires not only facilities but, also, a great deal of technical knowledge and above all, a high standard of ethics for public welfare.

At various times, chemical substances have been proposed for use in food products which we manufacture and distribute. More than twenty years ago, we undertook a study of the use of antioxidants to inhibit the rate of development of rancidity in fats. One of these antioxidants, gum guaiac, was subject to most complete biological testing.

Where there is a well established usage over a period of time sufficient to cover life span of man, this should be scrutinized as good evidence in the establishment of maximum levels even though animal experimentation is incomplete.

This problem of chemicals in food involves residues from insecticide treatment, from defoliants, plant hormones, etc., as well as those added in processing or treatment. The presence of deleterious substances may be just as harmful if they are accidental contaminants as if purposely added.

CONTROL WITHOUT IMPAIRMENT

There is another side to this problem which, in the long run, is of nearly as great importance as that of preventing the use of toxic chemicals. I refer to the possible harm that could be done by inhibiting progress if the law were improperly administered. To take the position that chemicals in food are bad and must be prevented at all costs would, eventually, impede man's progress in his struggle to master the forces of nature. It must be obvious to all that food production on the farm in many cases depends on the use of insecticides. Thus, it will be seen than an arbitrary ruling may have a tremendous effect on the food supply. A little study will provide numerous illustrations on an equally beneficial effect of chemicals in imparting good functional properties to food substances. The prevention of the use of such chemicals would create a handicap in the utilization of food quite as important as the prohibition of insecticides would adversely affect food production.

For reasons indicated previously, it would seem to be in the public interest to provide in any revisions of the Food and Drug Law a clear and decisive statement of the requirements necessary to secure approval for the use of such chemical substances. The wording of the Law should be such as to protect the consuming public first, but, also, to protect the food producer and processor against arbitrary and scientifically unsound rulings of an Administrator.

An illustration of such a positive and unequivocal statement of the requirements of the Law is to be found in Section 4 of the Meat Inspection Act (21 USCA, Section 74) which reads in part as follows:

> " . . . and said inspectors shall mark, stamp, tag, or label as 'Inspected and Passed' all such products found to be sound, healthful, and wholesome, and which contain no dyes, chemicals, preservatives, or ingredients which render such meat or meat food products unsound, unhealthful, unwholesome, or unfit for human food."

Safety is the first and by all odds the most important consideration with respect to human food. The food industry has always subscribed to the principle of safety first, and by and large is favorable to a compulsory program for pre-testing of all new chemical substances in food. Our industry must make its position clear on this point.

It is time the various segments of the food industry anounce in unequivocal terms the high standard of ethics which has in the past and will in the future be its guide. We must not remain silent while others give the wrong impression of our industry.

I am glad to report that this question is, at this moment, under consideration by at least six such food trade associations and I am confident they will soon announce a set of principles by which they operate. Such principles should, and I believe will, cover the following points:

1. It is the responsibility of the food manufacturer and distributor to produce and distribute foods which are wholesome and nutritious and to safeguard against any contamination or adulteration which would render them unwholesome.

2. The food industry should continue to improve its products and it should not be afraid to use new materials providing these new materials have been thoroughly tested to assure against any hazard to the consumer.

3. The food industry should acknowledge that one of the factors affecting public health is the wholesomeness of food and that safe guarding public health is a proper function of government.

4. The food industry should favor an amendment of the Federal Law to give the regulatory bureau such as the Food and Drug Administration sufficient authority to prevent the use of any new substances in food if such use creates a hazard to the consumer.

ALLEGATIONS OF TOXIC SOLVENT-EXTRACTED SOYBEAN MEAL

In the current news an outbreak of illness is alleged to have been traced to the consumption of milk from cows that were fed soybean meal which had been de-fatted by extraction of the residual fat therefrom with the nonflammable organic solvent trichloroethylene. A conference of fifty representatives from the industries concerned, the American Veterinary Medical Association, the American Medical Association, the U. S. Food and Drug Administration, the U. S. Department of Agriculture, the Livestock Sanitary Board, departments of health, and agriculture experiment stations, was held at the agriculture Experiment Station, of the University of Minnesota, St. Paul, on May 27, to review the situation. Without dissent, they issued the following statement:

BIOLOGICAL EFFECTS OF TRICHLOROETHYLENE EXTRACTED SOYBEAN OIL MEAL

The soybean has rightly been accepted for a long time as a valuable component of diets of animals and humans. In animal feeds the defatted residue of soybeans continues to be one of the most valuable sources of protein. The removal of oil from soybeans is carried out commercially either by pressing or by extraction with fat solvents. For the latter purpose a special grade of purified naphtha is employed successfully on a large scale and the defatted meal thus produced is used extensively for various industrial purposes and in diets of man and animals. No evidence of harmful effects produced by naphtha extracted soybean oil meal has been presented when the meal is used according to recommended feeding practice.

During the last few years another solvent, trichloroethylene, has been introduced in several smaller extraction plants in the United States for the removal of oil from soybeans. One of the principal advantages claimed for the use of trichloroethylene is the fact that in comparison with naphtha it is relatively nonflammable, thus requiring less extensive operational control measures. Trichloroethylene has been used for similar purposes earlier in Great Britain, Germany Italy, and recently in Japan.

Soon after the commercial introduction of the trichloroethylene process for the production of soybean oil meal there were reported in this country cases of a hemorrhagic disease among some cattle which had consumed this product for variable periods of time. In some areas the incidence of morbidity and mortality have been high and in many cases it could be clearly established that trichloroethylene extracted soybean oil meal was one of the constituents of the ration of the affected animals. This experience is similar to that reported by Stockman in Great Britain in 1916 and since that time by others in Germany, Holland, Italy, and Japan. It has been possible in several instances to produce experimentally a hemorrhagic disease in cattle and calves by feeding them trichloroethylene extracted soybean oil meal. On the other hand, experiments are on record, and they agree with observations made on farms, where the feeding of trichloroethylene extracted soybean oil meal in quantities up to 3 pounds per day had been well tolerated by cattle for periods exceeding 200 days. Evidently, not all lots of trichloroethylene extracted soybean oil meal have the same effect quantitatively on cattle.

The symptoms of the disease in cattle are essentially those of an aplastic anemia with a marked reduction of leucocytes, neutropenia, relative lymphocytosis, a decrease in circulating platelets, erythrocytes, hemoglobin, and various degrees of hypoplasia of the bone marrow. The mucous membranes of the animals reveal petechial and ecchymotic hemorrhages; epistaxis and hemorrhages from the rectum, vulva, and prepuce are frequently observed. The latter symptoms are accompanied by elevated body temperatures and frequently followed by death within a few days. Necropsy reveals extensive hemorrhages throughout the body. Fatal attacks of this disease may occur after the feeding of trichloroethylene extracted soybean oil meal has been discontinued for several weeks. No effective treatment of the affected animals is known at present.

(continued on page 43)

CURRENT DAIRY FARM METHODS*

(Report of the Committee on Dairy Farm Methods)

Committee reports of recent years have dealt with subjects concerning Dairy Farm Methods of such importance that it seems impossible to eliminate them from this report. Subjects such as the cleaning of milking machines and utensils, cleaning and sanitizing farm dairy pipelines in place, mastitis, detergent-sanitizers, as well as many others, have been discussed by previous committees as well as by groups from other organizations. Of course the problems that are presented by these subjects deserve more study. It seems clear, however, that many of them are so controversial that definite, specific conclusions, such as this committee would like to make, may be beyond our scope, except as continuing problems. As one committee member has stated, "such problems as cleaning milking machines have been discussed fully and there is abundant information on recommended procedures that will produce the desired results. The difficulty lies in the fact that actual farm practices are not in keeping with recommended procedures. This is evidenced by the failure to attain full compliance on clean utensils and milking machines." This member goes on to say, "Information is needed on the reasons for deficiencies in farm practices and what can be done to correct them."

Milking Machines

For further study on the subject of cleaning milking machines, it might be wise for this committee to collaborate with committees from other groups or organizations. A uniform procedure which is acceptable and meets with general approval, and perhaps, will be accepted and used in actual farm practice, is our goal.

Before leaving the subject of the cleaning of milking machines it might be well to state again the procedure that is usually the pattern followed by most milking machine manufacturers in their instructions.

1. Immediate rinse of all milk contact surfaces with luke-warm water, 110°F to 120°F. This temperature is somewhat above the melting point of butterfat and thus facilitates its removal, yet not hot enough to coagulate proteins or to deposit calcium and magnesium salts from hard water due to the changes in the bicarbonate-carbonate ratios, etc., in the water.

2. A warm water detergent solution wash following either the milking machine manufacturer's recommendations or those of the detergent manufacturer. Temperature recommendations usually are from 120°F to 150°F.

3. A warm rinse to remove all the detergent-soil solution. Here is a place in the procedure that perhaps needs further study. Recommendations for the temperature of this rinse ranges from 120°F to as high as 200°F.

4. Storage. All parts should be protected from contamination during storage. The question of wet or dry storage of the rubber parts now appears. One committee member states, "It is my opinion that if the first three steps are properly carried out it makes little difference whether or not we store the rubber parts between milkings in a lye or chlorine solution, or dry."

5. Sanitizing the assembled milking machine before using. A chlorine rinse immediately prior to milking appears to be universally approved.

6. An additional recommendation which appears to be well accepted is the use of two sets of inflations, each set to be used on alternate weeks. Each set of inflations should be boiled in a lye solution (2 to 3 percent caustic) at the end of one week's use, then stored in a dark cool place for 2 weeks rest.

Maintaining the airline or vacuum hose in a clean condition from the standpoint of quality milk production is another subject which provides conflicting opinions. It seems to the committee that it is a good practice to see that all airline hoses are maintained in a sanitary condition. It is a good procedure to follow, and if contamination can occur from dirty airline hoses regular cleaning would eliminate the possibility.

The use of a milkstone remover may occasionally be indicated by a deposits being built up on the milk contact surfaces of the equipment. Such milkstone removers should be used in accordance with the manufacturer's recommendations as such removers vary considerably in their composition.

Until the results of further study indicates otherwise, your committee recommends generally the above procedures.

Cleaning and Sanitizing Farm Dairy Pipelines In Place

This subject, too, has been discussed in previous reports. There still exists a wide difference in opinion among milk sanitarians relative to accepting this method of cleaning and sterilization.

There is little doubt that the installation of "pipeline milkers" on dairy farms will continue to increase. These installation are adaptable to almost any type of milking barn. They may be used in the conventional stanchion type barn as well as the so-called milking parlor.

Literature, in recent months, has many articles on this subject, as much research is being carried on.

Dr. W. H. Haskell, of Klenzade Products, Inc. presented a paper at the last year meeting in Glenwood Springs, Colorado, on Cleaning and Sanitizing Permanent Pipe-line Installation. This paper was published in the December, 1951, issue of the *Milk Dealer*. Dr. Haskell outlined

*Presented at 39th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., Minneapolis, Minn., Sept. 18-20, 1952.

the program for in-place cleaning and sanitizing of milk pipelines on producing farms, as follows:

1. "The entire system should be flushed out with tepid water until the return water is clear of all traces of milk. This pre-flushing is important and a water temperature of about 100°F should be maintained.

2. "Flush wash the entire system with a balanced alkaline detergent solution, maintained at a temperature of 150°-160°F. Continue this circulation for 30 minutes. All stallcocks should be brush washed. The higher temperatures recommended result in greater chemical activity resulting in more efficient cleaning.

3. "Rinse line with clean water temperature of 125°-135°F—until all traces of the cleaning solution are removed. Use of proper test kits will establish the rinsing time for each installation.

4. "Before use, flush line with an approved chlorine solution of tepid temperatures—200 ppm—for at least 20 minutes. Cold chlorine rinsing tends to create condensation on both the inside and outside of the piping. This results in drip from the outer surface and the gathering of moisture on the inner surface of the pipe. While circulating the chlorine solution each stallcock should be opened and about one quart of the sanitizing solution allowed to escape.

The practice of flushing lines with cold water following the sanitizing rinse is not recommended due to the danger of recontamination.

5. At least once a week—oftener if water conditions make it necessary—use a balanced organic acid detergent solution in place of the alkaline cleaner. This alternate use of alkaline and acid detergents is designed to prevent the formation of mineral deposits on the equipment.

6. "Releasers, milk pumps, receiving vessels, inflations, etc., should be dismantled at least once a week or oftener and hand brushed."

Dr. Haskell goes in, in his paper, to describe the use of a sponge, as a special cleaning aid. The sponge is inserted on the pressure side ahead of the pump and forcing it through the line by the tepid water flush.

One member of the committee has discussed this problem in detail and is in practical agreement with above procedure. This member raises some questions about pipeline milkers that are worthy of repeating at this point.

1. Are the milk contact parts made of non-corrosive materials? What about glass and plastic?

2. Is the system so designed that all parts may be readily dismantled and cleaned if it should be decided that dismounting is a necessary procedure?

3. How should pipelines be connected? Is a gasket to be desired or are ground-joints satisfactory? What about slip-joints?

4. It is agreed that pipelines should slope. What degree of slope should there be? Is a minimum drop of one-sixteenth inch per foot satisfactory?

5. What about condensation; possible contaminaton of the milk by detergents, sanitizing agents? How best can we avoid such contamination.

It appears to your committee that the evidence from studies on cleaning and sanitizing of pipelines in place on the dairy farm is practically 100 percent favorable.

BULK COLLECTION OF MILK AT PRODUCER FARMS

Bulk collection of milk at producer farms has been discussed in the last two reports of the committee. As is true with "pipeline milkers", the installation of the bulk collection system on producer farms will, no doubt, continue to increase.

Two members of the committee, L. O. Tucker of Washington State, and C. F. Bletch of the Maryland and Virginia Milk Producers Association, have submitted thorough discussions of their experiences with the bulk collection of milk at the farms. In recent months many reports have appeared in the dairy journals describing the system in various sections of the country.

In general, there are four types of tanks now in use throughout the country.

1. The plain insulated tank. Milk cooled over a surface cooler then stored in the tank.

2. A cold wall tank, which has refrigeration coils or a liquid refrigerant in the jacket between the outer shell and the inner stainless steel shell.

3. An integrated tank with submersible surface cooler and condensing unit built into it.

4. An enclosed case, originally designed for cooling cans, but which has been converted into a bulk cooler. This has one or two compartments with one or two tanks, respectively, which can be pulled out of the case for cleaning. This two tank system permits holding morning milking in one tank and evening milk in the other.

Bletch and Tucker, in their discussions, lists some of the advantages and disadvantages, together with problems yet to be solved.

Advantages:

1. Producers are reporting a savings in shipping loss of milk. Bletch states that his company has secured figures indicating the average saving with bulk shipment is 1½ pound per 10 gallon can.

2. It is a labor saving system by the elimination of washing and sterilizing multiple containers, and the handling, lifting, and rolling of cans.

3. The system makes refrigeration virtually mandatory, thus we have a reduced opportunity for bacterial growth.

4. The area of utensil to milk surface is lessened with a conse-

quent contamination factor reduced.

Disadvantages:

The disadvantages present some of the problems that must be considered with this system.

1. The high initial investment or cost. This may eventually result in fewer but larger producers. The small producer may not find it possible to enter the milk producing business because of the high investment and cannot start with a very few cows and gradually build up his volume.

2. Roads from the highway to the milk house may need rebuilding to allow the tanker in to pick up the milk.

3. Electricity must be available, generally speaking.

4. The problem of returned milk for off-flavor. The inclusion of poor milk may easily reduce the quality of a large volume.

5. Some milk houses may have to be remodeled or new ones built to accommodate the tank properly.

6. A better trained truck driver may need to be employed. He will have the responsibility of occasionally rejecting the milk that is unsatisfactory. He also will have to measure and sample milk.

MASTITIS CONTROL

The following is quoted from a previous report of this committee: "The control problem is exceedingly complex. The concern of all interested groups very definitely exists but to date in most areas little success has been attained in coordinating the efforts of these various groups. The producer, agricultural colleges, veterinarians, and public health officials, all have selfish interests which should be an aid in the development of some workable control plan. Some states have mastitis control boards and this may be the leadership necessary to insure success. The degree of success of the program is going to depend upon the degree of cooperation attained. It necessarily must be a long range program and will require a great deal of educational effort. In this, public health officials, producer associations and agricultural colleges can collaborate in a helpful manner." This statement still holds true today.

We are all aware of the progress made with the use of the antibiotics. We, also, are cognizant of the problems presented by their use. It has been shown that milk obtained from treated quarters of the cow udder contains appreciable amounts of antibiotics as long as 72 hours or six milkings after the final treatment. There is also some evidence that the time may extend to six days. Much more study or research is needed for accurate determination as to when the effects of the drugs are lost. There is one thing, that we, as sanitarians, can do. We can make the producer aware of these problems created by antibiotics in milk. If this is not done, it is unlikely that normally appearing milk will be withheld from the supply going into dairy plants.

RECOMMENDATION

In conclusion, the committee would like to make a suggestion it believes might aid the work of future committees. For several years past, the committee has reported on several problems in each report. This necessarily means that one or two members selects a subject they care to study, another member some other subject, and so on. Thus the report cannot go into too much detail on any one subject. It is suggested that one subject, maybe two, be assigned to the committee each year, by the Executive Board of our organization, perhaps by mutual agreement of the committee members, or even by group action of the milk section. Given one or two subjects with all committee members working on the problem, contact can be made with other groups or organizations studying the same problem and collaborate with them. Such an arrangement, it appears, would result in obtaining more valuable information and a greater degree of uniformity.

J. M. DOUGHTY, *Chairman*
CHESTER BLETCH J. C. FLAKE
R. G. ROSS L. O. TUCKER

ALLEGATIONS OF TOXIC SOLVENT-EXTRACTED SOYBEAN MEAL

(continued from page 40)

Recent observations made on farms as well as some experiments suggest that under certain conditions a severe hemorrhagic disease of sheep is associated with the feeding of trichloroethylene extracted soybean products. A horse has developed fatal aplastic anemia and extensive hemorrhagic lesions following the experimental feeding of trichloroethylene extracted soybean oil meal.

In view of the evidence referred to, it is suspected that trichloroethylene extracted soybean oil meal contains some agent which is toxic to some species. Residual trichloroethylene as such is apparently not responsible for the effects of the meal. The toxic agent has as yet not been identified and hence there are no chemical tests available for its detection. It appears to be transmitted through the bovine placenta but no reliable evidence is available concerning its accumulation in the tissues of cattle or its transfer into the milk. These questions, however, should be studied and carefully considered in relation to the possible effects of consumption of animal products by man.

Studies on this problem have been handicapped to date by the lack of a biological test system other than the bovine specie but they should be continued until the toxic agent, its mode of action and possible measures for its detection, control and prevention have been recognized. In view of these developments, it is indeed fortunate from a practical standpoint that the production of trichloroethylene extracted soybean oil meal was never more than a small percentage of the total tonnage of soybean processed and that its production has now virtually been suspended.

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POULTRY PROCESSING SANITATION CODE

The Institute of American Poultry Industries is sponsoring the draft of a model code for poultry processing sanitation. Seven public health and seven industry representatives met in Chicago recently to work out something that would meet the need without delay. This is particularly important in view of the increasing number of poultry regulations springing up in cities and states, many of them acting as trade barriers and revenue measures. This type of ordinance, together with a lact of uniformity among cities and states, creates serious problems for everyone.

Government representatives on the liaison committee include: Dr. R. K. Anderson, Denver Department of Health; T. E. Sullivan, Indiana State Board of Health; Dr. John D. Porterfield, Ohio Department of Health and secretary of the State and Territorial Health Officials Association; R. W. Hart, Kansas City Regional Office, U. S. Public Health Service; Charels L. Senn, Los Angeles Department of Health; Dr. James H. Steele, director of the Veterinary Division U. S. Public Health Service; and Dr. James Lieberman, U. S. Public Health Service.

Industry representatives on the committee include: Dr. W. H. Haskell, Klenzade Products, Inc., Dr. C. H. Koonz, Swift & Company; Ray E. Firestone, Firestone and Company, Inc.; George Herr, Birds Eye Division of General Foods Corp.; Edward W. Priebe, Jr., of Priebe and Sons, Inc.; Chester B. Franz of Chester B. Franz, Inc.; and Cliff D. Carpenter, of the Institute of American Poultry Industries.

THE BASIC SANITATION CODE for poultry processing, which public health officials are preparing as a suggested guide for cities and states, was thoroughly reviewed at the second meeting of the liaison public health-industry group, held in Chicago October 28th. Good progress is being made, and changes in the first draft of the code, suggested by both public health and industry representatives, will be considered in readying a second working draft for exploration by the liaison group at a third meeting early in 1953. Representatives attending the October session are shown above. *Seated,* left to right: J. O. Parker, Dr. W. H. Haskell, Dr. Cliff D. Carpenter, Dr. James H. Steele, Ray E. Firestone, T. E. Sullivan. *Standing*: Dr. Carl H. Koonz, Dr. R. K. Anderson, Dr. Joseph Atkinson, Dr. James Lieberman, Dr. Raymond Helvig. Five of the group shown here are from industry, six from government.

U.S.P.H.S. WEEKLY COMMUNICABLE DISEASE SUMMARIES

DR. PAUL BROOKS
Montgomery, N. Y.

This "brief" covers 14 weeks, including that ending December 6. They recorded, in this period, approximately 39 outbreaks in the food-milk-water group. The majority, as usual, were gostroenteritis: *staphylococcus* or *salmonella.* Fourteen of the 39 followed group dinners, picnics, etc., 4 of them wedding affairs (a send-off for the bride and groom!). The largest, reported from Oregon, was one of over 400 cases (ham—*Staphylococcus aureus*) following a picnic.

This time we have one water and two milk appearing but with "question marks" in all. In a Tennessee church camp there were cases of "gastroenteritis" and an estimated 100 of infectious hepatitis. The campers were dispersed before investigation could be made. When made it revealed that the spring water supply was subject to contamination from toilets in 3 cabins. There might have been a mild case of hepatitis in one of the cabins.

Massachusetts reported 62 cases of gastroenteritis in an institution for boys. Fifty-nine had drunk milk. The raw milk (from their own farm) contained streptococci of "the viridans group." Kentucky: 63 gastroenteritis following a school meal. No food available for examination but, 3 days later, *Staphylococcus aureus* found in a previously unopened bottle of *pasteurized* milk.

From Maine came a report of 81 cases of "Streptococcal sore throat" following eating oyster stew. Cultures from all cases and a cook showed *"Streptococcus viridans."* The authorities available to me give, as the incitant of streptococcal sore throat, only hemolytic streptococci of Lancefield's Group A. Some more "question marks!"

From various parts of the country have come recently reports of cases of salmonella infection, in infants, following the use of commercial dried egg yolks.

CONFERENCE ON DRY MILK STANDARDS

Dry milk has come more and more into focus as a factor in manufactured dairy products within recent years. Due to the improved quality of the product its acceptability has risen sharply. For this reason officials in industry and in public health have undertaken research into the matter, and have been interested vitally in the establishing of standards for interstate use.

As a result of group opinion in 1951, the National Conference of Interstate Milk Shipments asked for the formation of a special committee to study the possibilities of setting standards for grade A dry milk. The committee first delved into research matters, leaving standards for a later date.

Finally, In New Orleans, in October of this year, the special committee met and drew up a tentative set of standards which will be placed before the general assembly of the National Conference at the 1953 annual meeting in June. If the regulations are adopted, they will be referred to the United States Public Health Service. When the USPHS adopts them, they will become the recognized regulations for Grade A non-fat milk solids.

BIOGRAPHY OF HAROLD J. BARNUM

Born on a ranch near Steamboat Springs, Colorado, November 17, 1902. Moved to Kalispell, Montana in early childhood. After graduation from High School, engaged in farming for two years. Entered Montana State College in 1923. Graduated with a B.S. in Dairy Manufacturing in 1927. Received M.S. in Dairy Husbandry from Michigan State College in 1929.

Entered employ of Detroit Health Department as Milk Sanitarian July 1, 1929. Accepted position of Milk Sanitarian and City Chemist for City of Ann Arbor, Michigan, May 1, 1930. He was city sanitarian from early 1943 to July 1944. In July 1944 resigned to become sales representative for Calgon, Inc., of Pittsburgh, Pennsylvania, in the Central Michigan territory. In January 1946 organized his own milk quality control laboratory servicing dairy plants in Detroit and South Eastern Michigan. In late 1947 he was selected to serve as the Chief of Milk Sanitation for the re-organized Denver Department of Health and Hospitals in Denver, Colorado. He holds the same position at present.

Mr. Barnum served as Secretary-Treasurer of the Michigan Association of Milk Sanitarians for ten years. He has served as Chairman of the Dairy Farm Methods Committee, a member of the Coordinating Committee and the Committee on Chocolate Milk of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS.

MEMBERS OF SPECIAL COMMITTEE ON DRY MILK STANDARDS

LEFT TO RIGHT: (seated) J. T. Walsh, Assistant Director of the American Dry Milk Institute, *Chairman;* Harold Wainess, Chief Sanitary Officer, Chicago Health Department; S. M. Rogers, Milk and Food Consultant, Regional Office, United States Public Health Service, Chicago; C. W. Pegram, Chief, Dairy Division, North Carolina Department of Agriculture; K. G. Weckel, Department of Dairy and Food Industries, University of Wisconsin; Dick B. Whitehead, Supervisor of Food and Milk Control, Mississippi State Board of Health; C. H. Holcombe, Director of Products Inspection, U. S. Department of Agriculture, St. Paul. Minn. Martin M. Kloser, Supervisor of By-Products, Bowman Dairy Company and Chairman of the Industry Group; H. Luther Hortman, Director, Division Milk and Dairy Products, Louisiana State Health Department.

THE LIMITATIONS OF CONSUMER FOOD PROTECTION UNDER EXISTING LAWS*

C. W. CRAWFORD

Commissioner of Food and Drugs
Federal Security Agency
Washington, D. C.

Consumer protection in the field of nutrition, under existing laws, is limited in two important respects:

(1) Widespread quackery is building an extensive "folklore of nutrition" which distorts facts of the real advances of nutrition science. This menances health by encouraging ailing and uninformed persons to rely on nutritional nostrums instead of using readily available and adequate foods or seeking competent medical care.

Much nutritional quackery cannot be curbed under laws against false labeling and false advertising. Current myths spread by numerous self-designated "authorities" are based on (a) theories on soil depletion and so-called organic gardening; (b) misconceptions regarding effects of food processing and cooking; (c) exaggeration of the extent and importance of "subclinical deficiencies."

A continuous program of education is needed, and should emphasize particularly the distinction between facts and pseudoscientific speculations to combat the spread of faddism.

(2) Growing use of food additives emphasizes a serious gap in consumer protection under the Federal Food, Drug and Cosmetic Act. The law does not require testing of new ingredients from the standpoint of safety before they are used in foods sold to the public. Most manufacturers do such testing but some do not.

A ferment of competitive development aimed at improvement of foods is stimulating the use of additives. Testing programs and methods of testing have not kept up with tasks imposed by new development. The present abundant food supply of the United States is the safest and most nutritious in history. Nutritionists are urged to keep vigilant to avoid any decline.

*Abstract of address delivered at National Food and Nutrition Institute, Washington, D. C. on Dec. 9, 1952.

WESTERN PENNSYLVANIA SANITARIANS ASSOCIATION

The Western Pennsylvania Sanitarians Association was formed four years ago and consists of 48 members in good standing. An active member must be an approved inspector. Associate members must be actively connected with the dairy industry. Meetings have been held four times annually in Butler, Pa. with an average attendance of 60 men. We generally have a specialist or some one who is a recognized authority in the industry as the principal speaker for each meeting. We also hold a short business meeting and usually a discussion period for such subjects the group may be interested in. We all feel that our organization has served as a wonderful medium for exchange of problems and ideas and also as a means of getting better acquainted with each other. Interest in the organizaztion seems to grow as the years go by.

Our last meeting, held in September, was in the form of a fish fry and corn roast. This particular meeting was thrown open to all commercial representatives and was more or less an experiment. Sales representatives are not admitted as members to our group and have never before been invited to any of our meetings. Yet, realizing the need for commercial men in the industry, we have decided to hold an annual affair of this sort and give the tradesmen an opportunity to meet our men. The experiment proved to be very much of a success and will certainly be repeated next year.

Our next meeting will be held in November. However, the complete program is not as yet made up. Present officers of our group are listed below:

President: H. L. Albert, Johnstown Sanitary Dairy Co., Johnstown, Pa.

Vice-President: Charles Montebelle, Meadow Gold Dairy, Pittsburgh, Pa.

Sec.-Treas.: Homer Young, Isaly Dairy Co., Pittsburgh, Pa.

H. L. ALBERT, *President*

WISCONSIN WINTER COURSE IN DAIRY FIELD WORK

The Department of Dairy and Food Industries, University of Wisconsin, will hold a winter course in dairy fieldwork, March 30 to April 11. It is designed to teach the techniques of quality control of milk supplies. A review of the various milk ordinances is presented. Special emphasis is placed on the procedures used in maintaining efficient dairy farm and dairy plant sanitation programs. For additional information, send inquiries to J. Frank Wilkinson, 108 Agricultural Hall, University of Wisconsin, Madison 6, Wisconsin.

OREGON ANNUAL DAIRY SHORT COURSE

The 42nd annual short course and convention of Oregon Dairy Industries will be held in Withycombe Hall, Oregon State College, Corvallis, February 16, 17, 18, and 19. The first two days will be devoted entirely to short course and the last two days to convention. A full program of technical lectures, demonstrations, and discussions of timely interest is being prepared. Top flight out-of-state speakers will be assisted by members of the Oregon dairy industry and Oregon State College. Entertainment features will include social hours, a men's smoker, and a banquet. Samples of dairy products for the contests held in connection with the convention must be sent to Corvallis during the first week in February.

FIRST ANNUAL DAIRY ENGINEERING CONFERENCE

The First Annual Dairy Engineering Conference will be held February 25 and 26, 1953, on the campus of Michigan State College at the new Kellogg Center, to discuss the engineering features of dairy plant operation and design, and also dairy equipment design. The conference is being sponsored jointly by the Departments of Agricultural Engineering and Dairy in cooperation with representatives from the various groups from the dairy industry.

The purpose of the conference is to permit an exchange of ideas on dairy equipment which will be beneficial and of interest to the dairy plant engineer and dairy equipment designer from the standpoint of more efficient utilization and design of equipment. Possibilities of developing new equipment to improve the processing operation will be discussed.

The material is to be presented from an engineering standpoint but should be of interest to dairy plant superintendents and managers as well. Plans are being made for the discussion of the following major subjects by outstanding authorities in the industry.

1. Refrigeration plant design and operation.
2. Steam boiler operation and selection.
3. Efficient operation of ice cream freezers.
4. Plant design layout and time and motion studies.
5. Building design and materials of construction.
6. Cleaning equipment and accessories.
7. Water treatment for dairy plants.
8. Engineering challenges in the dairy industry.

For further information and a copy of the program, write to the Department of Agricultural Engineering, Att: Dr. Carl W. Hall, Michigan State College, East Lansing, Michigan.

DAIRY INDUSTRIES EXPOSITION TO BE HELD IN ATLANTIC CITY IN 1954

The 19th Dairy Industries Exposition will be held in Atlantic City in the fall of 1954, according to an announcement by the Board of Directors of Dairy Industries Supply Association, sponsor of the Show.

DAIRY PRODUCT IMPROVEMENT INSTITUTE POSTPONES MEETING TO MARCH

We had planned to have the 1953 Annual Meeting of the DAIRY PRODUCTS IMPROVEMENT INSTITUTE, INC. at the Hotel Commodore in New York City in January, as usual. We have now definitely arranged to have our Sixth Annual Meeting in the East Ballroom of the Hotel Commodore in New York City on Friday, March 20, 1953, because the very important program that we have selected cannot be held until then.

OSCAR SELANDER DIES: CP EXPORT MANAGER

Oscar H. Selander, 53 export manager for The Creamery Package Mfg. Company, died December 5, 1952 in Michael Reese Hospital, Chicago, Illinois.

He was born in Chicago where he attended Lewis Institute and Armour Institute. During World War 1 he saw active duty with the United States Navy.

From 1922 to 1939, Mr. Selander was associated with the Wilson Sporting Goods Company in the mechanical development and manufacture of golf balls. He joined Creamery Package in 1939 to assist in the development and sale of Pliofilm Hoods for milk bottles.

In 1946 he became export manager of Creamery Package and recently he was appointed a Director of the Dairy Industry Supply International Association.

He leaves his widow, Edna; a son, Navy Lt. Herbert H. a brother, Carl T. and two sisters, Mrs. Agnes White and Mrs. Hilma Seefeldt. Services were held in Chicago December 8, 1952.

Kellogg Center for continuing Education where the Dairy Engineering conference will be held.

46TH ANNUAL MEETING MASSACHUSETTS MILK INSPECTORS ASSOCIATION

On January 7th and 8th the Masschusetts Association held their 46th annual meeting at the Sheraton Hotel, Worchester. Due to heavy snows my train was two hours late arriving on the 7th, but the weather was mild and sunshiny in Worchester and I was there by the time the meeting started.

There was an excellent attendance and a number of very good papers such as: "In-Place Piping", Mr. F. M. Skelton, General Ice Cream Corp., Schenectady, New York; "Changes in Procedures in the Tenth Edition of Standard Methods for the Examination of Dairy Products", Dr. A. H. Robertson, Director, State Food Laboratory, New York Department of Agriculture and Markets, Albany, New York; "High Temperature, Short Time Pasteurization and Inspection Techniques", Harold Thompson, Regional Milk and Food Consultant, Federal Security Agency, Public Health Service; "The Salient Legal Aspects Every City and State Employee Should Know about Retirement" John J. Manning, Massachusetts State Retirement Board; "Quality Headache-40 Quart Size", Fred Smith, Cowles Chemical Company.

Joe Donovan, (left) Brookline. retiring President of the Massachusetts Milk Inspectors Association and H. G. Lindquist, Amherst, new president.

The Banquet was held the evening of the 7th, with excellent entertainment during and following the meal. Joe Donavan, President and the other officers did a fine job. In December I had been an easterner in Washington State now I was a westerner in Massachusetts but the presence of so many Irish made me feel that I belonged. Curt Chaffee and "Clif" Goslee from the Connecticut Association were there as well as Ken Johnson and some of his men from Maine. Rhode Island was represented too.

Met several fellows who have been members of International Association for over thirty years and that together with the fact that the Massachusetts Association is forty six made me feel young.

Dr. Shrader came over from Wolleaston, the afternoon of the 8th and we had a long conference which is always so much better than conferring by mail. Rushed to catch my train at 5:40 P. M., back home through a lot of snow.

"Red"

WASHINGTON STATE MILK SANITARIANS ASSOCIATION HOLDS FOUR SECTIONAL MEETINGS

On December 5 - 8 - 9 - 10 four sectional meetings were held by the Washington Association at Spokane, Centralia, Seattle and Yakima. I was afforded the great pleasure of speaking at all of these meetings. Arriving in Spokane the night of December 4th, I was met by Harold Janzen, Yakima, and Bill DuBois, Spokane. Over coffee and doughnuts we got acquainted and made plans for the next day.

On December 5th, spent a most enjoyable day visiting with Roy Olsen, Spokane City Health Dept., Harold Janzen, Bill DuBois and Ben Luce. The meeting in the evening was well attended and we had an excellent discussion after my talk.

On December 6th, Harold Janzen took me to Ellensburg where we were to meet Leslie Jenne with whom I was to go to Olympia. We went by the way of the Grand Coulee Dam. What a sight this was and I shall never forget the trip up the Columbia River Valley. Arrived in Ellensburg about 1:00 P.M. where Les was waiting for us. It was a beautiful day but we ran into snow going over the pass and Les had to put chains on the car. The pass looked very Christmas like with the snow on the fir and cedar. On the west side of the mountains we ran into rain which continued all the way to Olympia. I learned that the rain was very welcome though, as the water was low in the reservoirs.

Stayed over the weekend with the Jennes and now I know why Les is always so cheerful and pleasant. Mrs. Jenne is a charming person, and an excellent cook. Little "Jan", very pretty and sweet, is four and she made me feel much at home too. Mr. and Mrs. Cameron Adams, (Cameron is Director

of the Dairy Division, State Dept. of Agriculture), came to dinner Sunday evening making it a most pleasant occasion.

Monday December 8th, Les and M. L. Strommer took me to Longview where we were taken through the largest saw mill in the world, this mill saws 1-1/2 million feet of finished lumber a day. We, also, were conducted through a huge paper mill which produces 700 tons of paper daily. Then back to Centralia for the meeting that evening, which was held in a pretty old home famous for their food. With an excellent dinner, a roaring fire and about thirty present, it was a a meeting to be remembered.

Tuesday, December 9th, Les took me to Seattle where we met L. O. Tucker, State Health Dept. Went to lunch with "Les" and "Tuck" at one of the most unusual places I have ever seen; it was in a huge old house completely filled with antiques from all over the world. We met Frank Logan, Dave Jones and Bill Oldenburg here so we had quite a luncheon session Dave and "Tuck" proceeded to show me the points of interest in Seattle in the afternoon.

The meeting was held at Washington University, in the new Union Building in the evening. Almost a hundred members were present, and it was an inspiration talking to them.

Wednesday December 10th, Les and I were off to Yakima. Stopped at Harold Janzens home in Yakima where Mrs. Janzen treated us to coffee and some of that famous Yakima apple pie. Boy! was it ever good! Due to my getting fouled up on my reservations the Yakima meeting was last instead of first as had been planned. Consequently we had the smallest attendance but this only enabled me to get better acquainted with them, so it was one of the nicest evenings we had.

The Washington Association is really a wonderful, live wire bunch. Their hospitality is tops, too. Starting out two years ago with twenty-

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five members. Today they number 191 and they certainly were quite an inspiration to me.

Thursday December 11th, Fred Troemmel took me to Portland, Oregon where I was to catch my train back. Had dinner and spent the evening with "Spike" Deal, City Health Dept., caught 10:00 P.M.. train for an uneventful trek home.

CALENDAR

Feb. 11-14—Institute of American Poultry Industries, Kansas City, Mo.

Feb. 16-19—Oregon Annual Dairy Short Course, Withycombe Hall, Oregon State College, Corvallis, Oregon.

Feb. 19-20—Winter Meeting of National Pickle Packers Ass'n. Chicago, Ill.

Feb. 21-25—National Canners Convention and Machinery Show, Chicago, Ill.

Feb. 25-26—Dairy Engineering Conference, Michigan State College, E. Lansing, Mich.

March 1-6—National Frozen Food Convention, Chicago, Ill.

March 9—Washington State College Institute of Dairying, Pullman, Washington.

March 15-18—American Chemical Society, Los Angeles, Calif.

March 20—Sixth Annual Meeting, Dairy Products Improvement Institute, Hotel Commodore, New York, N. Y.

March 22-24—American Dairy Ass'n., Chicago, Illinois.

March 22-25—National Sanitary Supply Ass'n., Conrad Hilton Hotel, Chicago, Ill.

March 30-April 11—Wisconsin Winter Course in Dairy Field Work 108 Agricultural Hall, U. of Wis.

April 20-22—National Frozen Foods Industries Exposition, Grand Central Palace, New York, N. Y.

June 21-25—Thirteenth Annual Meeting, Institute of Food Technologists, Boston, Mass.

Sept. 1-3—Fortieth Annual Meeting, International Association of Milk and Food Sanitarians, Inc., Michigan State College, East Lansing, Michigan.

E. M. OTT HEADS PENNSALT SALES RESEARCH DEPARTMENT

PHILADELPHIA — All statistical and analytical functions pertaining to marketing in the Pennsylvania Salt Manufacturing Co. have been combined into a newly organized Sales Research Department, with E. M. Ott as manager, it was announced by William P. Drake, Vice President.

The new department will explore markets for new products under consideration in the Research and Development Division or the Sales Development Department and will conduct studies associated with existing markets and services. To make this work more effective, the Sales Analysis Department becomes a section of the new department.

Mr. Ott formerly was Manager of the Security Analysis Department. The work of this department has been transferred to the Office of the President. The new department manager, a graduate of Drexel Institute of Technology, joined Pennsalt in November, 1940, and has been engaged in market research and chemical engineering. He served in the Chemical Warfare Service from January, 1942, to February, 1946, being separated from services as a captain.

Mr. and Mrs. Ott and their two sons live at Blue Bell, Pa.

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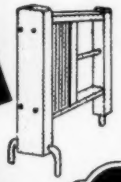

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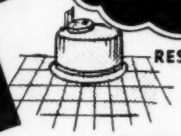

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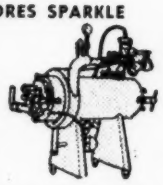

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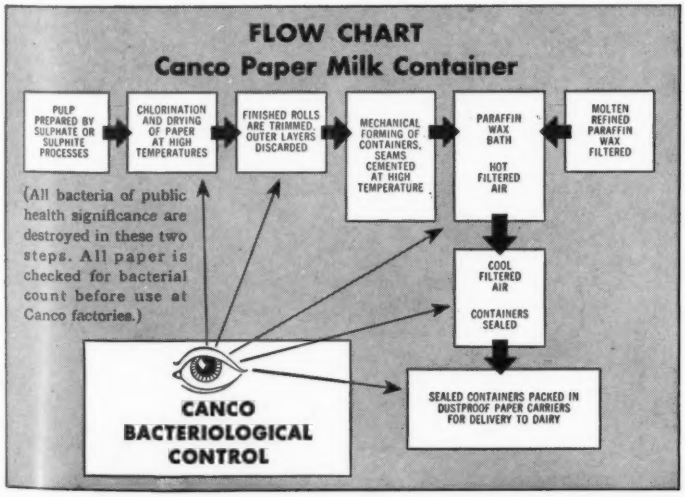
Add'l. 100's	1.60	1.60	3.00	4.20	7.00	3.37

THROUGH THE EYEPIECE

(Crucial Points in Bacterial Control of Canco Milk Containers)

A bath in continuously filtered molten paraffin waterproofs every Canco paper milk container, and is one of the factors contributing to its sterility.[1] (See Flow Chart below.) Each container is immersed in the bath, and then drained in an atmosphere of hot filtered air. The entire operation is mechanical.


FLOW CHART
Canco Paper Milk Container
PULP PREPARED BY SULPHATE OR SULPHITE PROCESSES
CHLORINATION AND DRYING OF PAPER AT HIGH TEMPERATURES
FINISHED ROLLS ARE TRIMMED, OUTER LAYERS DISCARDED
MECHANICAL FORMING OF CONTAINERS, SEAMS CEMENTED AT HIGH TEMPERATURE
PARAFFIN WAX BATH
HOT FILTERED AIR
MOLTEN REFINED PARAFFIN WAX FILTERED
(All bacteria of public health significance are destroyed in these two steps. All paper is checked for bacterial count before use at Canco factories.)
COOL FILTERED AIR
CONTAINERS SEALED
CANCO BACTERIOLOGICAL CONTROL
SEALED CONTAINERS PACKED IN DUSTPROOF PAPER CARRIERS FOR DELIVERY TO DAIRY

CANCO PAPER MILK CONTAINERS are made on automatic machinery, operating in rooms which meet rigid sanitary requirements. Machines print the paper, then fabricate it into blanks from which the containers are shaped. If the paper must wait between operations, it is kept *in dustproof steel cabinets*. The finished containers are made on machines designed by Canco engineers . . . men with years of experience in designing food-packaging and handling equipment. These are some of the reasons why rinse tests reveal *no bacteria at all* in 80% of the finished Canco paper milk containers.[2] The remaining 20% show an average of .007 organisms per cc.

1. Bulletin 495, University of Illinois, 2-43
2. The Journal of the Texas Public Health Association, 2-50

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NEW YORK
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DIFCO

Bacto-Dehydrated Media for Microbiological Assay of VITAMINS and AMINO ACIDS

These media contain all the necessary nutriments for the growth of specified test organisms for the microbiological assay of vitamins and amino acids except for the component under assay. These basal media require only the addition of specified increasing amounts of the vitamin or amino acid being assayed to obtain a growth response which may be measured by acidimetric or turbidimetric methods for the construction of standard curves. The vitamin or amino acid content of the material under assay is determined by adding appropriate concentrations of the test substance to the basal medium and comparing the growth response obtained with that of the standard.

BACTO-RIBOFLAVIN ASSAY MEDIUM
BACTO-NIACIN ASSAY MEDIUM
BACTO-THIAMIN ASSAY MEDIUM
BACTO-PANTOTHENATE ASSAY MEDIUM
BACTO-B_{12} ASSAY MEDIUM USP
BACTO-CS VITAMIN B_{12} AGAR
BACTO-FOLIC ACID ASSAY MEDIUM
BACTO-PYRIDOXINE ASSAY MEDIUM
BACTO-BIOTIN ASSAY MEDIUM
BACTO-CHLORINE ASSAY MEDIUM
BACTO-CF ASSAY MEDIUM
BACTO-METHIONINE ASSAY MEDIUM
BACTO-TRYPTOPHANE ASSAY MEDIUM
BACTO-LEUCINE ASSAY MEDIUM
BACTO-LYSINE ASSAY MEDIUM
BACTO-ISOLEUCINE ASSAY MEDIUM
BACTO-ARGININE ASSAY MEDIUM
BACTO-TRYOSINE ASSAY MEDIUM

The method employed in carrying stock cultures of the test organisms and preparing the inoculum for microbiological assay is important. The following media have been developed especially for carrying stock cultures and for preparation of the inoculum:

BACTO-MICRO ASSAY CULTURE AGAR
BACTO-MICRO INOCULUM BROTH
BACTO-NEUROSPORA CULTURE AGAR

BACTO-VITAMIN FREE CASAMINO ACIDS, dehydrated, is an acid hydrolysate of vitamin free casein prepared especially for laboratories investigating microbiological assay of vitamins.

Descriptive literature available upon request

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